MODERN PLASTICS

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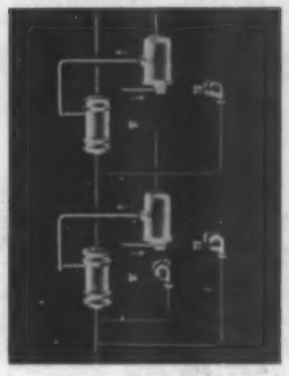
Cover color this month VARSITY PURPLE (Created by Textile Color Card Association)



MARCH

Networks of pipes, tubes, evaporators, condensers, pumps and valves all jumbled together in apparent disarray make the job of describing modern industrial power systems difficult. But miniature models, fashioned after the equipment used in service are simplifying this job. Next month Phillip W. Swain, Editor of Power, tells us how models of cast resin make it possible to tell an otherwise complex story interestingly and simply.

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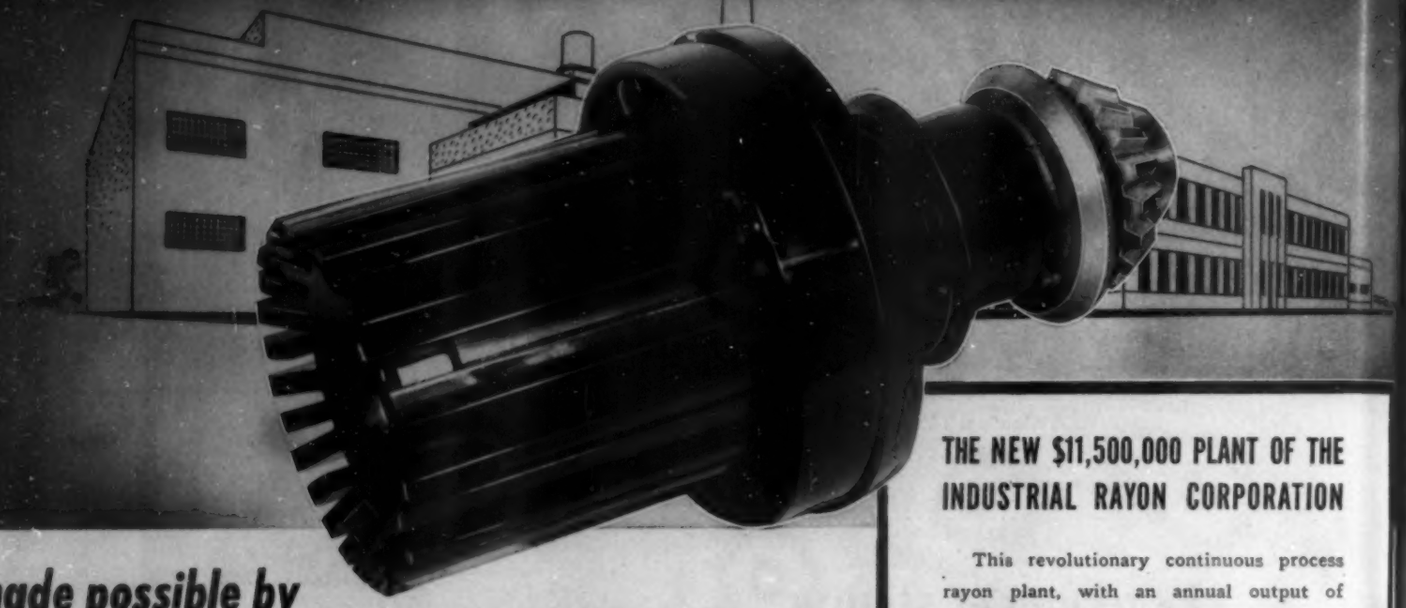
FIRST AND ONLY CONTINUOUS VISCOSE RAYON PLANT



THE NEW $11,500,000 PLANT OF THE INDUSTRIAL RAYON CORPORATION

This revolutionary continuous process rayon plant, with an annual output of 12,000,000 pounds, is the result of many years of experimental and developmental work. Perfected by Rayon Machinery Corporation, wholly owned subsidiary of Industrial Rayon Corporation, this process was made possible by the molded plastic members of the reel.

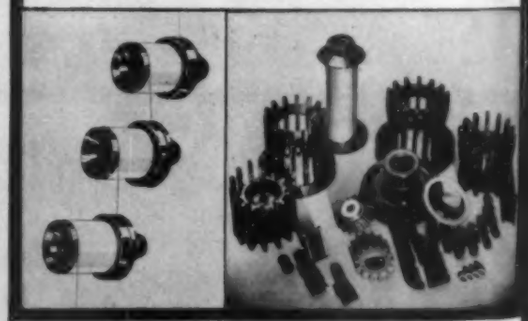
Richardson engineers, designers and plastics technicians are proud to have had an active part in writing this new epoch-making chapter in the history of the rayon industry.

made possible by the PLASTIC SPINNING REEL Precision Molded *by* Richardson

In Painesville, Ohio, stands the world's first plant for the continuous production of viscose rayon yarns. There a succession of chemically resistant plastic reels of ingenious, highly-developed design, make it possible to carry rayon yarn from the spin bath where it is formed, through all the processing, cleansing, drying and twisting operations to plastic bobbins on which it is first wound up.

Costly, time-consuming operations and multiple handling are eliminated by use of the reels, which carry each individual thread through all the processing stages for direct treatment, insuring the ultimate in product uniformity.

Heart of the continuous process is the plastic spinning reel, developed with Richardson collaboration from complex experimental models to a simple precision molded composite reel. In addition, numerous other Richardson molded and laminated plastics are widely used—jet unions; thread guide holders and brackets; INSUROK laminated gears and seal rings; bobbins and other parts—because of their unvarying physical characteristics and resistance to all spinning and processing liquors.



INSUROK

the superior plastic by Richardson, is available in sheets, rods, tubes, punchings, and other forms for fabrication in your plant, or in completely finished parts ready for assembly. Richardson facilities encompass the use of Bakelite, Beetle, Durez, Indur, Plaskon, Resinox, Tenite and other forms of synthetic resin plastics. Literature and INSUROK catalogues on request.

Devoted exclusively to plastics, Richardson ha unexcelled facilities for the volume productio of intricate molded and laminated parts and fi ished products to exact specifications. Richardso complete service, and the same engineering an technical skill that proved its value in the In dustrial Rayon Corporation development, ar available to all users of plastics.

The RICHARDSON COMPANY

Melrose Park (Chicago) Ill. New Brunswick, N. J. Indianapolis, Ind. Lockland, (Cincinnati

MODERN PLASTICS

FEBRUARY 1939 VOLUME 16 NUMBER 5

TELEVISION PRETTY SOON

by EVE MAIN

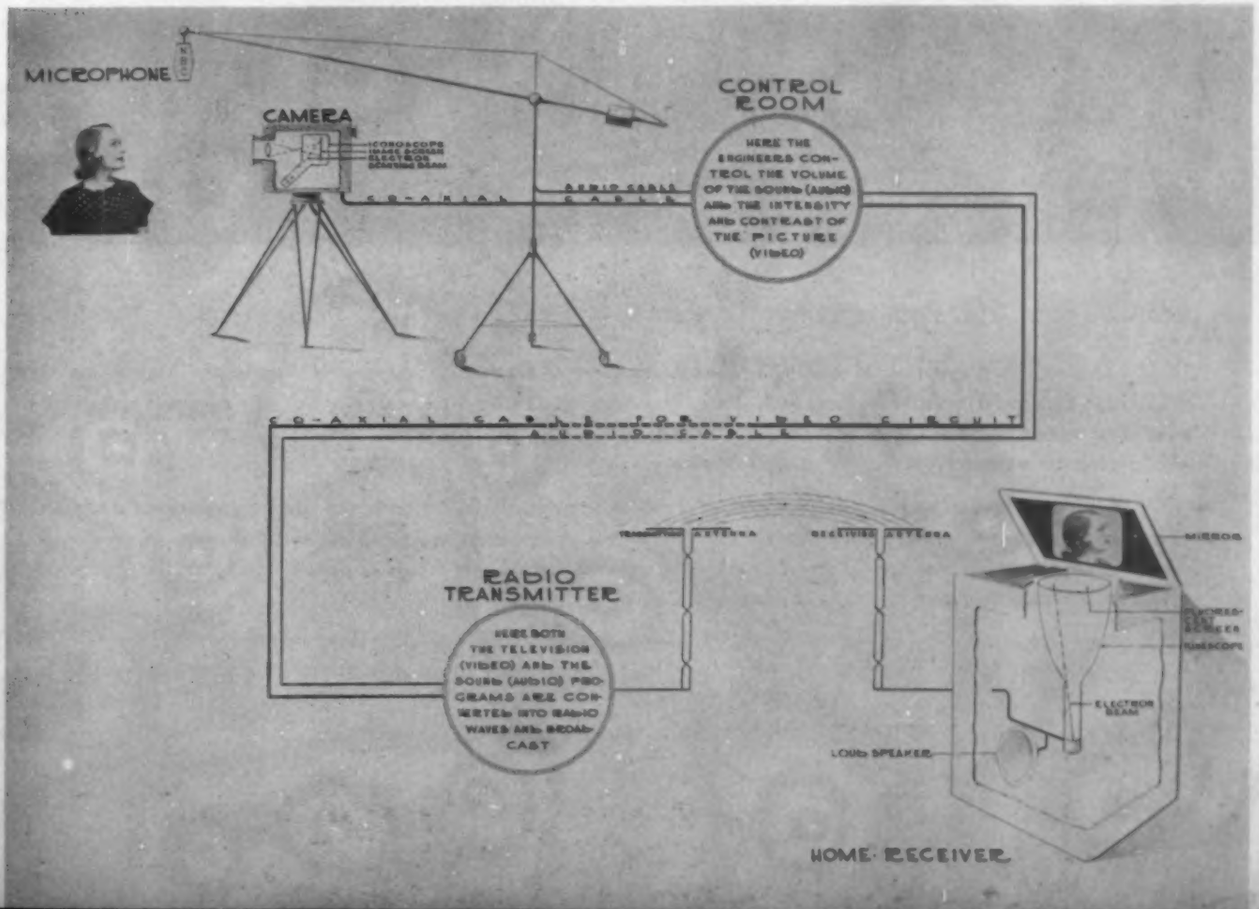
IF YOU WANT TO KNOW WHAT TELEVISION pictures will be like; if you've wondered how they are wafted through the ether and picked up on the screen of a receiving set in the living room; if you'd really like to see what goes on behind the scenes—just grab your hat and come along to the National Broadcasting Company at Radio City.

Television Tour reads the neatly lettered sign just inside the door. Following the directions of the ticket-selling, information-dispensing young lady at the desk, we join a group of other sightseers eagerly waiting to be shown this triumph of science. The guide, a tall, broad-shouldered blond young man in the snappy dark blue uniform associated with NBC ushers and pages soon appears and we are off to historic adventure.

Into an elevator that whisks up so fast nobody has a chance to say a word. Out again and along a broad, softly carpeted corridor to be brought up short before a closed door to wait for stragglers. Satisfied that his charges are all accounted for, the guide opens the door and leads the way into a long, narrow passage. On one wall are photographic enlargements. One shows actresses and cameras in position on an outdoor set, in a scene from a play that was telecast a few months before. Another pictures a portion of the first fashion show to be recorded by television.

In a room at the end of the passage is displayed some of the earliest television equipment. One of the first scanners stands out particularly. It is an ugly, complicated piece of apparatus all of five feet from front to

The chart below gives a graphic idea of how images (video) and sounds (audio), picked up in the studio by the Iconoscope camera, are translated into radio waves and broadcast. It also shows how these radio waves are turned back into light and sound through the kinescope, then reflected from a fluorescent screen to a mirror where they may be seen in the home


MICROPHONE
CAMERA
CONTROL ROOM
HERE THE ENGINEERS CONTROL THE VOLUME OF THE SOUND (AUDIO) AND THE INTENSITY AND CONTRAST OF THE PICTURE (VIDEO)
CO-AXIAL CABLE
CO-AXIAL CABLE FOR VIDEO CIRCUIT
AUDIO CABLE
RADIO TRANSMITTER
HERE BOTH THE TELEVISION (VIDEO) AND THE SOUND (AUDIO) PROGRAMS ARE CONVERTED INTO RADIO WAVES AND BROADCAST
MIRROR
ELECTRON BEAM
LOUD SPEAKER
HOME RECEIVER

LENOX R. LOHR, President of NBC, says:

"Television, including the sale of receiving sets and the broadcasting of television programs on a regular schedule, will be made available to the general public in the New York area early next Spring. Each day we hear something new about this new development in the science of radio. Many of the stories are based on fact; some are pure fantasy. However, they do indicate that the public is television conscious.

"The National Broadcasting Company, as the result of exhaustive tests in the RCA laboratories, and the presentation of telecast to private audiences, is now in a position where satisfactory broadcasts may be presented to an audience that wishes to see as well as hear. So far, indications are that the spread of television will be to the larger centers of population first and that, compared to sound broadcasting, the programs will be of short duration.

"From a technical standpoint the problems can be solved. But the economic problems faced are tremendous. We are not yet sure how or when television can pay its own way. We shall take one step at a time in order best to serve the public interest."

back and as many or more feet from top to bottom. Imagine trying to fit one of these harmoniously into a cozy living room! Evidently television engineers felt that way about it, too, judging from the compact, well-styled cabinet receiving set that came along later.

"What are these for?" one of the group asks. He is looking into a recessed glass case at one side of the room where two objects are displayed, one labeled *Iconoscope*, the other *Kinescope*. We listen, and learn that the invention of these two cathode ray tubes by Dr. Vladimir K. Zworykin, now director of the Electronics Research Laboratory of the Radio Corporation of America, did more to advance television in this country than almost any other development.

The basis of all television is photoelectricity. Unlike sound which requires modulation only before it is sent, whole, over the waves, a picture must be taken apart for transmission and reassembled at the receiver. The Iconoscope tube, in the camera, does the taking-apart job by translating light rays into electrical impulses, while the Kinescope in the receiving set is the builder-upper changing the electrical impulses into light rays.

Television

It works something like this: All visual images consist, in final analysis, of thousands of points of light of varying intensity. Such an image of a person or object in front of the television camera is projected by a lens system to a plate inside the Iconoscope. On this plate are thousands of little globules of silver coated with caesium, a photo-sensitive element. Each of these has the property of throwing off electrons in proportion to the intensity of light falling upon it. And in emitting electrons each of these cells becomes electrically charged. When the visual image is projected on the light-sensitive plate, these globules collectively convert the light image into a "picture" in voltages.

Placed round the neck of the Iconoscope are magnetic coils that deflect the electron beam and cause it to scan the plate in a pattern of 441 lines. It shoots up to the left-hand corner of the plate and follows across. Then the field changes and brings the beam back to the left again, repeating the process until the plate is covered from left to right, top to bottom, as one would read a newspaper or book. It moves so fast that the entire picture is scanned in a thirtieth of a second, 30 pictures a second, which gives the illusion of motion without any chance of flicker.

The electrical impulses together with added synchronization impulses pass through a coaxial cable to the control room where they are strengthened. Sound picked up by a boom microphone travels simultaneously through another cable to the same point where the volume is modulated and controlled. Then the picture (video signal they call it) and the sound (dubbed audio signal) proceed through their respective lines to the radio transmitter where they modulate radio carrier waves and are broadcast from transmitting antenna.

The Kinescope, placed upright in the receiving set, is a funnel shaped vacuum tube. The under side of the top is coated with a chemical which gives off light when the electron beam—twin brother of the one in the Iconoscope and working in the same way—hits it. So the electrical impulses revert to light rays, and the values of light and shadow on the screen, as reflected in a mirror in the top of the receiving cabinet, reproduce the exact image picked up by the television camera. Sounds simple—or does it?

Scenic effects

Anyway, the early-apparatus-room explored thoroughly, we trail along into a gloomy, closet-like space. A hangover-from-Chamber-of-Horrors sort of place. Nothing to be alarmed at, merely a visual effect, as important to television as sound effects are to radio. This particular scene, used to introduce a telecast Sherlock Holmes drama, portrays the corner of an old laboratory. Musty books flung carelessly on the top of a high wooden bench, glass retorts and measures on a shelf above, with an authentic-looking whiskey bottle (empty) tucked away in a corner. Over everything a thick coating of mold, dust and flimsy cobwebs. Near the front edge of the bench is a book, larger than the rest, with wooden covers and leaves. As shown on the television screen, these pages turn slowly, one by one, to announce the title of the play, the cast of characters and other pertinent information. At a certain moment, a candle feebly flickering beside the book goes out, in mystery circles a sure sign of death to follow. All very sinister and convincing. (*Please turn to page 62*)

Below, at the left, Dr. W. R. G. Baker of General Electric Co. views a television program on a receiver built in their laboratory. Center: An experimental set by RCA. At the right: Albert F. Murray, chief television engineer of Philco Radio and Television Corp. (extreme right) demonstrates an experimental receiver. None of these exact sets are available—yet

RALPH MANCUSO STANDS BESIDE ONE OF THE TWELVE TRANSLUCENT PHENOLIC RESIN FIGURES CAST OF MARBLETTE IN RUBBER AND PLASTER MOLDS. EACH STATUE STANDS NINE AND A HALF FEET HIGH, MEASURES EIGHT FEET ACROSS THE BASE AND WEIGHS FIFTEEN HUNDRED POUNDS. LIGHTED FROM WITHIN, THEY WILL FEATURE THE U.-S. GOVERNMENT EXHIBIT DESIGNED BY EDWARD H. BURDICK FOR THE NEW YORK WORLD'S FAIR. THE FEDERAL EXHIBIT, IN CHARGE OF THEODORE HAYS, EXECUTIVE ASSISTANT U. S. COMMISSIONER TO THE FAIR, WILL BE HOUSED IN A BUILDING UNDER CONSTRUCTION AT THE EASTERN END OF THE FAIR GROUNDS

A NEW "FIRST"

Figures of this size were never cast in synthetic resin before

THE DIMENSIONAL LIMITATIONS WHICH CUSTOM has set up as a theoretical boundary beyond which plastics cannot go, lie shattered at the feet of these translucent figures of gigantic size cast in rubber and plaster molds prepared by Ralph Mancuso.

More than seven years ago Mr. Mancuso, who is a sculptor, became interested in plastics when he sought a new material in which to reproduce his works of art for a popular market. He soon discovered that conventional methods of molding presented two major difficulties which stood in the way. First, was the matter of cost. Steel molds were too expensive to gamble with when production runs might not exceed a few hundred of each item. Second, was the matter of undercuts. Sculpture required these. Unrelenting steel molds prevented their economical reproduction.

Then he turned to cast resins which could be poured at the proper temperature and cured under heat without pressure. But the question of molds remained. Gelatin molds, which were all right for plaster, were too soft for resins. They couldn't be cured under heat. Rubber seemed a logical answer so he began experimenting with that.

He set up a shop over on the west side of New York City, installed a small vulcanizer, a couple of resin curing ovens, and went at it in real earnest. It took months to get rubber to behave as he wanted it to in the form of molds, but it finally did.[1] He worked out a formula by which he could make molds so cheaply that they were no longer a serious consideration when he wanted to reproduce a new item.

They could be made quickly, too. It was not unusual for him to talk with a prospective customer about some special shape he wanted to turn out in plastics, then come back to the shop, make a mold, and carry the completely finished molded sample back to his prospect the next day.

He made small jewelry and buttons mostly but found the market so highly competitive, and the volume of available business so small, that there was little profit in that sort of work. He felt after he had been working at it for a short time that he had started wrong and so the Moldite Corporation, which he called his company, was dissolved.

He decided his process had such tremendous possibilities for big castings in the art world that he gave up making small things altogether. He set up a studio which he called Art Plastics Company and began casting statuettes. Not very big ones, but some were two feet high. He often used clear resins because the statuettes were beautifully translucent and could be made with such gay and interesting colors. He made garden ornaments; waterproofed them so they would withstand the weather.

About this time the Diorama Corporation of Long Island City, one of the contractors for the huge figures to be used in the Federal Building at the New York World's Fair, began worrying about how they were going to carry out the specifications of designer Edward H. Burdick that these figures be translucent so they could be lighted from within. The original plan was to make them of glass but when they found that each figure would cost in the neighborhood of $68,000.00, that material became out of the question.

Conceiving the idea of using plastics, Mr. Burdick consulted authorities in the field; but they all shook their heads. It would be impossible, they said, to cast such large figures with metal molds, since during the curing process, the plastic would expand, cracking either the mold or the figure itself.

Mr. Burdick remembered reading about Mancuso and his experimenting with rubber molds, so looked him up to see what he could do. Mancuso said there was no doubt the statues (*Please turn to page 60*)

[1] Modern Plastics, September 1937.

Here at Art Plastics Company, the workshop of Mr. Mancuso, expert workmen spent days building each mold with unbelievable precision. Built in four parts carefully dove-tailing together, each requires more than a ton of plaster. When completed, it is taken to the casting plant where the resin is poured and cured

WHEREFORE INJECTION MOLDING

by L. K. MERRILL,* W. R. WHEELER* and G. C. MILLER**

Steps toward more rapid production and better moldings are made by improved heating cylinder designs

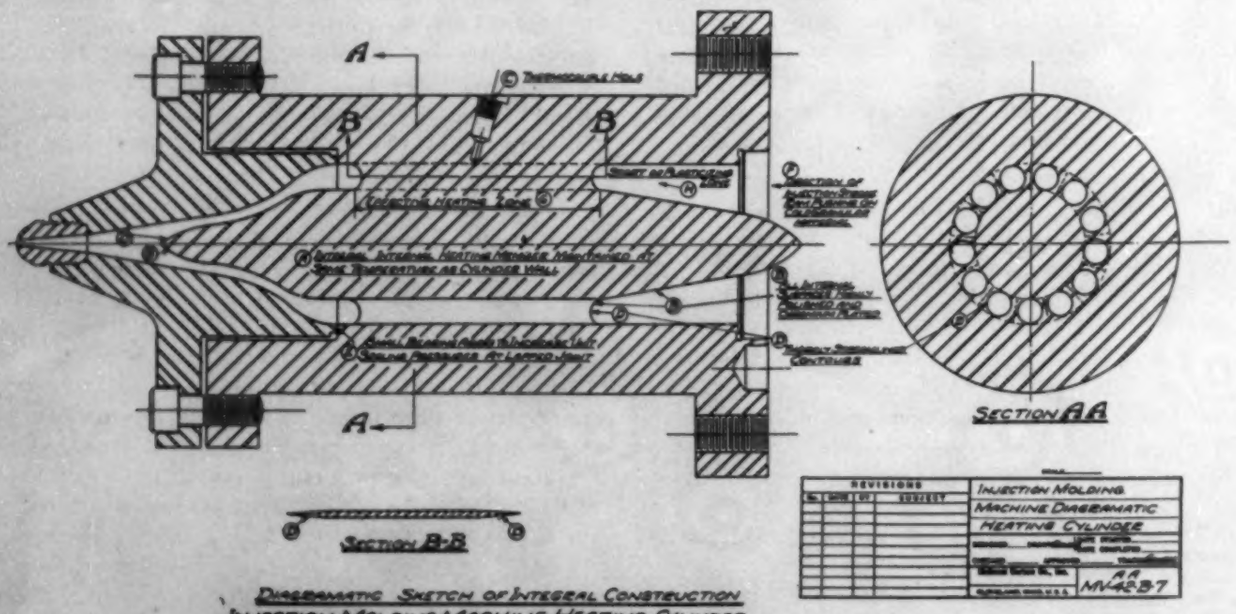
THE PROGRESS WHICH HAS BEEN MADE IN THE process of injection molding thermoplastic resins during the last few years presents an interesting commentary on, and example of, our American scheme of industrial development. The commercial exploitation of the process may be said to have been a typical "depression baby" and while its evolution and development are still going on, it is worthwhile to consider some of the future trends and tendencies in relation to the progress so far.

Practically speaking, within a 3-year interval the injection molding process for producing molded parts from synthetic thermoplastics (of the cellulose acetate, vinyl, styrol and acrylate resin types) has changed from a few "homemade" or imported (mostly German) machines operating on a few hundred pounds of resin per month, to a truly dominant factor in the plastic molding industry, involving operation of hundreds of machines and daily consumption of tons of material. Where machines were formerly rated in grams per injection cycle, they are now regularly producing castings of 6 to 9 ounces with little increase in actual operating cycles. Some particularly and commendably courageous pioneers have already shown the way with machines, materials and techniques capable of 32 oz. castings. Like most combination chemico-mechanical developments, the problems of increasing machine capacities, and thereby size of the formed articles, are by no means a straight line function of the actual casting weight and it would seem that continued progress would best be predicated on the collaborative development effort of (1) the material supplier, (2) the machine manufacturer and (3) the machine and material user. While this situation has obtained in a large measure during the development so far, it will undoubtedly become of increasing importance as the injection molding process moves from its present adolescent to a more mature phase.

Fundamentally, injection molding of synthetic resins is an adaptation of the die-casting process as applied to metals and which has reached such a high plane of technical development in this country. From a machinery standpoint the background in that industry has therefore been of considerable importance; mold closing, clamping, and adjusting mechanisms have been drawn largely from die-casting machine practice. The injection pressure mechanisms (now largely hydraulic in this country) are likewise clever adaptations from the die-casting as well as plastic extrusion and molding industries. It is the considered opinion of the authors that—from the standpoint of the machine user—the injection pressure mechanisms now available are deficient in ca-

* New Products Division, National Carbon Co., Inc.
** Plastics Division, Carbide & Carbon Chemicals Corp

These diagrammatic sketches show heating cylinders embodying some of the points discussed in the text. Both are of "integral" type construction. Fig. 1 illustrates the parallel path heating zone



DIAGRAMATIC SKETCH OF INTEGRAL CONSTRUCTION INJECTION MOLDING MACHINE HEATING CYLINDER

FIG. 1

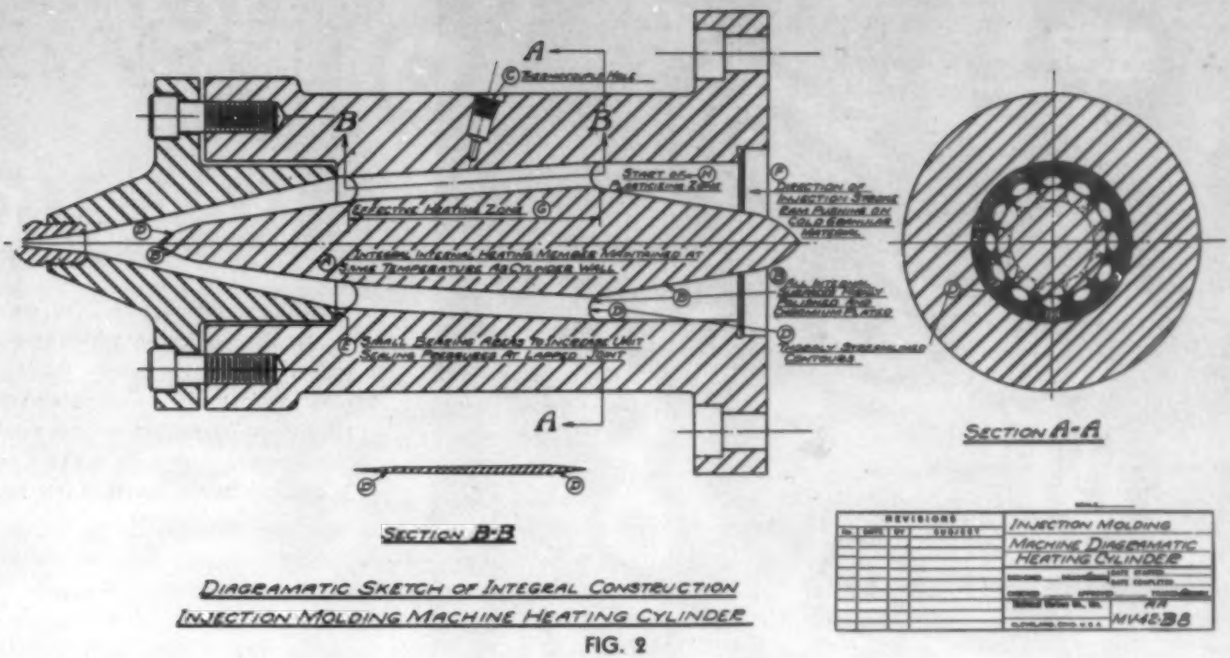


FIG. 2

Fig. 2 illustrates the converging path type of heating zone referred to in the text. Both of these sketches are referred to near the end of the article where results of their operation are explained

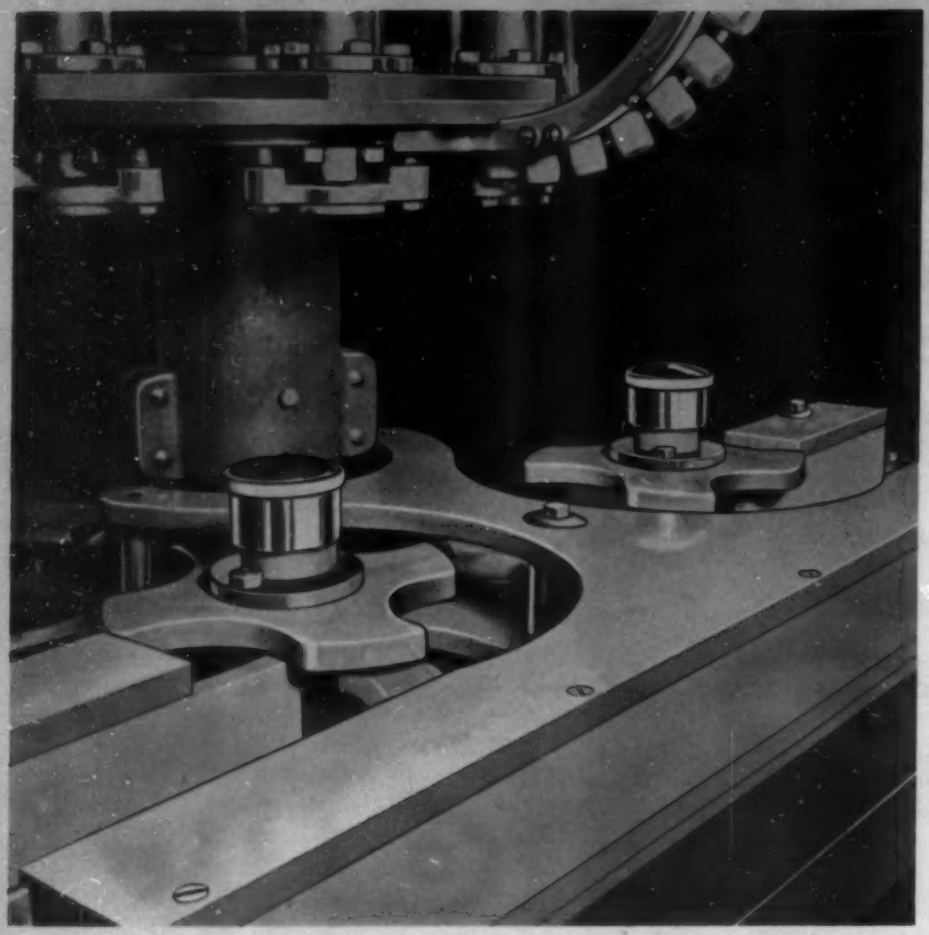
pacity. This is true, not so much from the standpoint of the total pressures available as the rate of application and maintenance of those injection pressures. It is confidently believed that, in the introduction of the plastic resin stream to the mold cavity, anything less than instantaneous filling of the cavity is a disadvantage and all effort should be bent toward approaching that goal. Obviously, these high injection stream velocities involve certain compromises from a mechano-hydraulic standpoint, but the machine manufacturer should consider these compromises from the standpoint of the quality advantages to be gained in the molded article as well as from the viewpoint of his own alleged limitations in machine design. It may well be that properly designed gas bottle accumulators have a valid application in respect to this feature, permitting high rates of pressure application and total pressures which can be maintained at the end of the injection stroke, which is the stage wherein straight hydraulic pressure application is the most deficient.

It is furthermore believed that as the art of injection molding continues to progress, it will be necessary to pay more detailed attention to heating cylinder design. This phase of the process has already gone through considerable evolution but there are indications that—by devoting suitable attention to design of heating cylinders—much can still be accomplished in the way of (1) production of stronger and more homogeneous castings, (2) minimization of heat punishment to the plastic, (3) preservation of cleanliness and color, (4) ease of cleaning and reduced maintenance and (5) more general and advantageous utilization of all available thermoplastic molding materials.

The heating cylinder on any injection molding machine must perform a rather strenuous task. It must accept solid granular material possessing very poor thermal conductivity characteristics (50 to 65 $\times$ 10^{-5}) with low gravity (1.05 to 1.35) and low specific heat (.25 to .40), then compress it without air entrapment, flux, homogenize and deliver a uniform plastic mass to the mold cavity. These functions must be performed at the rate of several cycles per minute and should be done with a degree of perfection as regards homogeneity and uniformity of the plastic leaving the nozzle which has not always been fully realized. Concurrently, these results must be accomplished with a minimum of pressure drop or loss through the cylinder. Otherwise, too large a proportion of the available injection pressure will be lost, leaving insufficient available for filling the mold cavity. The inside of the heating cylinder must, furthermore, be free from dead spots, cracks or crevices in which plastic material may lodge, lie dormant, and thereby be subject to color change and ultimate decomposition; and stream lining for complete scouring of the plastified charge at each cycle is a most important feature.

The matter of perfection and uniformity of heat transfer is an important feature because each particle of the plastic mass must be brought to the same ultimate plastic temperature without subjecting any other part of the mass to excessive temperature. In other words, the material immediately adjacent to the cylinder wall or heating surface must not be superheated and, therefore, the preferred heating cylinder should operate with as low as possible temperature differential between heating surface temperature and desired material temperature.

Practically all early heating cylinder designs provided for an internally fitted "spider," "torpedo," "spreader" or variously designated part which was centered within the main cylinder by lugs, sleeves or bearing surfaces closely fitted thereto. While (*Please turn to page 68*)



Bottles, rushing through this filling, corking, capping machine, are seldom broken and make little noise because the laminated Formica feed and discharge stars do not become "burred" as easily as metal. The laminated feed guide is also silent in contact with the bottles as they pass

PREVENT BREAKAGE—REDUCE NOISE

Laminated phenolic feed and discharge stars and guides on this bottling machine prove to be worth more than they cost

DURING THE PAST YEAR, THE U. S. BOTTLERS Machinery Company, bottling and packaging engineers, have been using a phenolic laminated plastic material for certain parts of their filling, corking and capping machines. These machines are production units, subjected to the most severe and abusive service, and because they are integral and important units in high-speed filling, bottling and corking lines in the liquor, food, chemical and drug industries, parts must not cause trouble and *must* stand up under the constant, hard pounding of production lines.

Formerly, the feed and discharge "stars" as well as the feed "guides" on their units were manufactured of metal, but experimentation in the engineering and manufacturing departments indicated that a laminated material could be used to advantage; and that these advantages of using a plastic would be beneficial to both themselves as builders of machinery and to their customers.

Many products handled on automatic filling machines and filled in glass containers are of a corrosive nature, especially in the chemical field, and considerable trouble was encountered in the use of metals because some of them were easily attacked by the corrosive elements. The use of a plastic completely eliminated this trouble. Today it is the rare exception when they run across any chemical that is filled on their machines that will attack the plastic used.

Contrary to a somewhat prevalent idea among laymen, glass is a tough material, and actual cases have been recorded where glass has badly damaged the feed or discharge "stars" of an automatic filling, capping or corking machine. This condition is brought about through the use of unskilled labor in the operation of these units. If the travelling bottle conveyor is not run in perfect synchronization with the automatic machine, it is possible for the bottle being fed into the machine to hit a point of the "star." The result is a broken bottle, but more serious is the fact that the bottle, because of its contact with the point of the star will have left a bad burr on the feeding star. This burr can badly scratch other bottles and if deep enough, it will sometimes crack or break bottles travelling through the machine. The use of a laminated plastic stops all this. If a bottle is incorrectly fed into the machine, the same thing happens—that is—the feeding star is nicked or burred but because the plastic (*Please turn to page 68*)

SMART, LIGHT AND DURABLE

by H. S. SPENCER*

A plastic case for a portable autographic register

PLASTICS ARE RAPIDLY STEPPING OUT INTO the society of the business machines. The pioneering effort of the manufacturers is really bearing fruit and we're beginning to see many smart new designs, modern, time-saving changes being effected throughout the field. Latest debut is that of the portable autographic register. While the portable type is not new, the application of plastics in this connection is, in that this is an entirely new development of a portable register. The mechanical and plastic features were developed together as the logical means of proper coordination of the two factors.

The primary thought was to improve appearance and broaden the appeal, and at the same time to provide better operation in a smaller, more compact, more flexible type of register. The application of plastics as a case material was a "natural" in this instance, as this equipment is handled a great deal in use. The permanence of finish in an extremely wide range of colors, plus the charm of the plastic surfaces made its use entirely logical. In addition to this, the flexibility of design permitted by molding presented an opportunity to develop pleasing, rounded contours not hitherto available or prohibitive because of die cost, if considered in sheet metal.

Considerable thought was given the factor of breakage to establish its true importance. Consequently, the design was directed toward maximum inherent strength, in addition to provision of adequate wall thickness. This unit which is molded in two sizes at present, consists of a plastic bottom and cover, in which is placed a metal chassis containing all the mechanical features. The bottom of the chassis, which is the bottom of the compartment holding the pack of forms, when in place closes off a space molded in the plastic bottom, which is used as a filing compartment for extracted tickets.

The tickets are ejected at the front end for about one-half inch by pressing the trigger handle forward. They are then grasped by the thumb and forefinger in the depressions in the center of the front of the case and pulled out, until stopped by the mechanism, and then torn off. The small flap-like door across the bottom of the front end is snapped down to open the filing compartment to receive the ticket copy, which is to be filed for bookkeeping records.

Krauth & Benninghofen, the makers of this register, have manufactured autographic registers for over fifty years for most of the major companies, who market them with the printed forms used in them. This development is a logical result of thorough study, coupled with that background of experience. The case was designed by Russell S. Katz, and the mechanical features were designed by Mr. Katz and Mr. Harry J. Waechter of the engineering staff of Krauth & Benninghofen.

*General Plastics, Inc.

PHOTO COURTESY DUREZ

1

2

PHOTOS COURTESY CHICAGO MOLDED PRODUCTS CORP.

The Cardineer filing system (Fig. 1) recently introduced by Diebold Safe & Lock Co., depends upon a molded plastic wheel, 21 in. in diameter to make 7000 cards immediately available to the operator at desk height. A smaller desk model (Fig. 2) employs a molded wheel 6 in. in diameter. Designed by Barnes & Reinecke, the plastic parts were engineered and molded by Chicago Molded Products Corp. The wheel when assembled has a chrome tube rim attached to turn it to the desired position

BREAKING RECORDS TO KEEP RECORDS

by J. O. REINECKE* and H. D. PAYNE**

Makes possible a unique card filing system

PLASTIC PRODUCTS ARE GENERALLY CHEAPER, better looking and more permanent than other materials. That's no longer news to men who have used plastics. But when plastics, in addition to being cheaper and better looking, are found to be the *only* material from which a given product can be made, then, we think, it is news. And, when the molded piece establishes a record for large molding executed with everyday equipment and facilities, the news value is further enhanced.

Such is the case of the Cardineer, a new record-keeping system. The ideal card-file system is one which enables the user to (1) read all cards in one common position, (2) read the entire face of each card—and the back as well—with but one adjustment, at (3) desk height, where the light is best and the fatigue least; which (4) enables several operators to work on the cards simultaneously, permitting division of work on peak load days, and which (5) permits removal and replacement of cards with one hand, eliminating the fatigue of reaching and stretching. That, the Diebold Safe & Lock Company decided several years ago, would constitute the completely accurate and economical card-filing system.

Into Diebold's Canton, Ohio, office three years ago walked George C. Buren, a Chicago insurance man, with his idea of how it could be done. The system as he outlined it consisted of a large wheel suspended in a cabinet. Index cards were to be threaded on metal arcs, which would then be attached to the wheel. In this way each wheel could hold about five thousand cards.

It was a beautiful idea. But the most important part of the device—the wheel—could not be made. Diebold, with all its eighty years' experience in making safes and locks out of steel, said it couldn't be done. If stamped metal were to be used it would have to be two stampings assembled. But a half-wheel couldn't be stamped in one piece. It couldn't even be made in three pieces, leaving out the consideration of whether it would operate satisfactorily after being assembled. Die-casting, the manufacturer thought, was a possibility. But the cost of a strong metal, plus the cost of a die designed to assure the necessary uniformity, plus the additional cost of finishing the casting, eliminated that possibility.

Some time ago inventor Bruen, weary but undiscouraged, took his idea to a designer—then to a molder. "Could the wheel be designed and produced in plastics?" he asked the designers. They thought Yes; were confirmed in their opinion by engineers of a molding plant. Then followed months of intensive planning and work. Blue prints, sketches, models, laboratory experimentation resulted. Finally the parts were molded, tested and approved. And then, only a (*Please turn to page 72*)

3

PHOTOS COURTESY DUREZ

4

* Barnes & Reinecke, Designers
** Chicago Molded Products Corp., Molders

Molded in two halves, this 21 in. wheel represents a progressive step in both chemistry and engineering. Each half, weighing 7½ lbs., is molded of a special grade of Durez to withstand shrinkage strain. The assembled wheel and the separate halves are illustrated in Figs. 3 and 4

What! No Picture

● No Sir! No pictures this time — because pictures can't tell this particular story!

Pictures can't show Plaskon's service to users!

Pictures can't show Plaskon's uniformly high quality!

Pictures can't show Plaskon's resistance to light and heat!

Even a thousand pictures would not explain the real reasons for Plaskon's great achievements—or the fact that it is the largest selling urea-formaldehyde plastic in the world!

True, pictures are interesting. But, pictures can't portray the constant advancements being made in Plaskon's modern Research Laboratory—or give you an adequate idea of the infinite care taken to make Plaskon the preferred plastic. No picture could show you Plaskon's great dielectric strength, its low degree of heat transference, its unusual resistance to water, oils and organic solvents, or prove to you that Plaskon is tasteless, odorless.

No single advertisement could illustrate the

e in a Plastics Ad?

many thousands of beautiful colors, tints, and hues that Plaskon has made available. Nor could any picture convince you that Plaskon Molded Colors don't fade. It is impossible, too, to illustrate Plaskon's ability to reflect and transmit light to an amazing degree. But—it *is* possible for us to show you interesting pictures of hundreds of different products that have been made more salable, more profitable, through the use of Plaskon—and explain to you how and why. For complete information, write

PLASKON COMPANY
Incorporated
2121 SYLVAN AVE. TOLEDO, OHIO
Canadian Agent: Canadian Industries, Limited, Montreal, P. Q.

PLASKON

★ MOLDED COLOR ★

The patented honeycomb construction is visible in the upper part of the Textolite heels, developed and molded by the Plastics Department, General Electric Co. This hole construction makes the all-plastic heels nailable with standard shoe machinery

600,000,000 MOLDINGS A YEAR

That is the potential market of this new injection molded shoe heel

IT IS CLAIMED THAT OVER 600,000,000 WOMEN'S shoes . . . more than 300,000,000 pairs . . . are produced annually in this country. Shop girls and matrons, stenographers and debutantes are alike in their fondness for new shoes, and lots of them. Alike, too, in that they want their shoes with high heels; more than half of the millions of pairs turned out are fitted with heels ranging from conservative cuban heels to towering spikes.

It is not surprising then that heels are so important in the manufacturing, merchandising, and repairing of shoes. They do much more than provide support to the last. They give form and grace to the entire piece of footwear. Shoe designers pay great attention to the height, size and shape of the heel. And necessarily so, because ever since women took to increasing their height and bettering their carriage with high heels, shoes have been designed with this feature foremost in mind. Then too, heels must stand a lot of wear. At each step the weight of the body comes down full force, pounding it against sidewalks, knocking it against staircases. It should fit into the motif of the shoe itself, so that it must be able to be lacquered or covered with a coating of the pattern, material or color of the rest of the shoe.

Wooden heels have been used almost universally up to now, but neither manufacturers nor buyers have found them fully satisfactory. Their greatest fault is their tendency to split, when being attached in the factory, when being worn or when new lifts are being nailed on. When a heel splits at the factory, it wastes time, holds up production and adds to labor costs. If it fails after the shoe is sold, it usually means the discard of that pair.

Besides being non-splitting, a heel should be light in weight and must not warp from heat or humidity. Since color, and unusual leathers and fabrics are used so much

on women's shoes, a satisfactory heel must also be able to be covered in these materials, and to hold them.

In order to overcome the difficulties that have been found in other types of heels, it has often been proposed that a plastic material be adapted. As far back as 1875, and ever since, patents have been granted intermittently on synthetic heels. But for one reason and another none has been found practical until now. The difficulty has usually been to find a means of attachment to the shoe. Since shoe manufacturers have many millions of dollars invested in equipment suited to nailing heels to shoes, a heel that could not be used on this equipment would be very slowly adopted, if at all. Most plastics soft enough to be nailed are not hard enough.

In the new injection molded cellulose acetate heel, this has been very ingeniously worked out. The unique honeycomb construction visible in the transparent models, is the thing that makes them practical. By providing a number of long vertical holes in the upper part of the heel, arranged with their openings close together over the upper surface, the acetate is made nailable. These holes are slightly smaller than the nails used on standard attaching equipment and when the nail is driven through the leather into the heel with a hammer-like blow, the thermosplastic material gives slightly and then springs back to grip the nail and hold it permanently. If the nail misses one of the holes, it is either deflected into the nearest one, or is driven right into the material itself. Since the plastic is resilient enough, there is no danger of cracking or splitting.

But the honeycomb construction didn't answer all the questions that had to be met before the new development was perfected. Most heels have at the lower tip a small piece of leather, which both cushions the step and takes the scuffing of walking. These lifts are replaceable and usually are replaced several times during the life of one pair of shoes. A cheap, practical method of refitting the lifts had to be found.

This, too, has been worked out in unique fashion. While lifts now used are ordinarily nailed to wooden heels, the Pearson Heel Co. developed a new snap-in lift for these plastics heels. The new lift is attached simply by inserting the clip in the lower part of the molding, where it fits into a recess. Although it is held tightly and will stay there indefinitely, it is easily removed by a slight prying.

Besides providing the necessary resiliency, the color possibilities of cellulose acetate give the heels another advantage. Since it is available in such a wide range of tints and shades, many shoes will use the heels without any coating or covering whatever. Some have been made up in magenta, brown, gold, green and black. The luster of the material, and the fact that the color cannot chip or peel, makes it doubly attractive in stylish modes. One model has been made up in a clear transparent material. In this case, the honeycomb construction adds an unexpected decorative note, particularly adaptable for evening wear. Quantity production of the heels in several standard colors and sizes has begun and unusual colors may be obtained either by special mixture of pigment with the acetate or lacquering transparent heels.

Despite the advantages the heel offers, they are inexpensive enough for use on footwear in the middle price brackets and eventually even on low-priced shoes.

Leather lifts are fixed to the heels by a patented steel clip, which fits into a recess in the molding. The Pearson Heel Co. has designed them to hold firmly, yet they are quickly replaced when new lifts are needed

1

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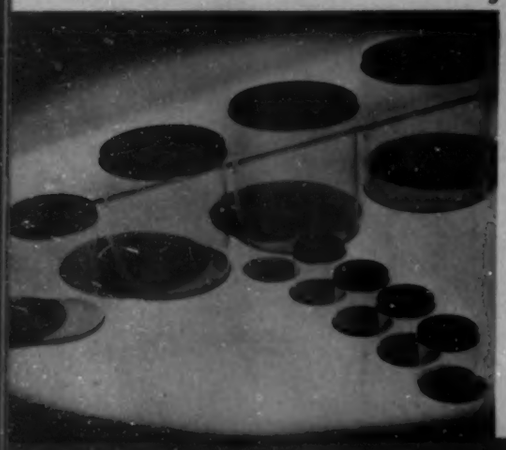

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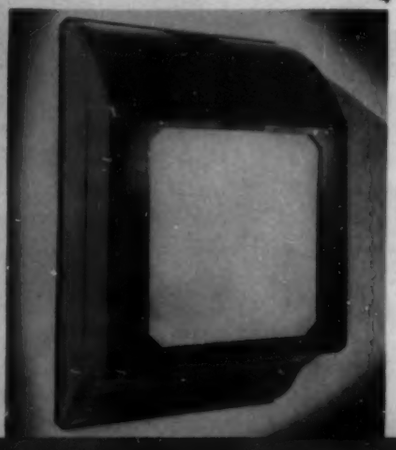

4

1. The Handy Plug may be wired without driving screws or stripping wire. Metal prongs, incorporated in the Resinox molding, pierce the insulation and grip the wire, making sure, tight contact. It is molded by the Waterbury Button Company

2. In both wall and table models, metal is used to set off the lustrous black of the moldings in these Swift and Anderson thermometer-barometer units. Northern Industrial Chemical Co. did the molding

3. Lumarith Protectoid cannisters are used to package or store a great variety of articles. Adequate protection and full visibility is insured by the transparent sides, while the metal top and base give rigidity

4. Boonton Molding Co. turns out this large combination medicine cabinet and paper towel holder for the Scott Paper Co. It is 19 in. high, 12 in. wide and 6½ in. deep, complete with a hinged door on the front and a recess beneath the door for the towels. Bakelite is the material

5. Barbers screw this McCulloch handle on empty cold cream jars and use them for shaving mugs. Elmer E. Mills Corporation injection molds the handle complete with threads

P L A S T I C S

6. Detroit Molded Products Co. is producing this waterproof cigarette case. Metal fittings, attached to the urea molding, both seal the case and allow it to be carried on a belt around a bather's waist

7. Pressing the plunger on this Seel-Flo faucet for refrigerator bottles starts the liquid flowing without gurgling; releasing it makes a sure, tight seal. The Remler Co., Ltd., are molding it of Durez

8. Various size diaphragms, fitted into these Lily-Tulip paper cup holders, adapt them to different size cups. The Northern Industrial Chemical Co. molds them, using Beetle for lighter colors and Bakelite for darker shades. Stricker-Brunhuber fashioned the original models

Manufacturers' addresses will be sent if you will write to the Editor, enclosing 3-cent stamp for reply

5

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9. The housing and base of this Vapo-Cresolene vaporizer is a non-conducting, heat resistant molding, allowing the unit to be equipped with an electric heater. Durez is the material; molded by Niagra Insul-Bake Specialty Company

10. Adrian M. Matthews conceived this carved portrait in white Catalin. Full advantage is taken of the smooth pleasant texture of the material to bring out warm tones, and deep shadows on the profile which is in relief. The plaque may be hung as a wall decoration or stood upright on a stand

11. Lighter in weight and easier to use, the Leroy lettering set for draftsmen and engineers has a transparent scriber in place of a metal casting. Knobs and fittings are readily attached. Boonton Molding Co. molded it of Lucite for Keuffel and Esser, Inc.

12. Counter display, electric sign and change tray are combined in this Ray-O-Vac unit. Coins in the tray make a contact which lights the sign, calling customers' attention to the batteries arranged on the sides. It is molded of Bakelite by the Richardson Company

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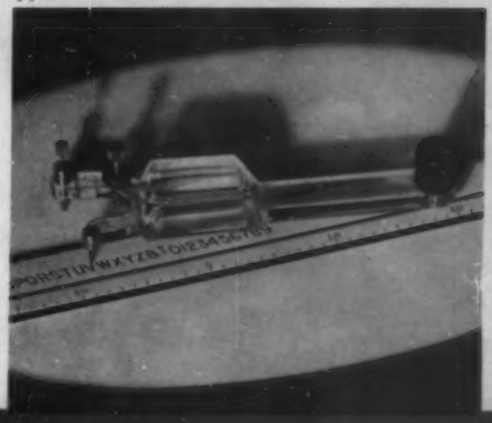

IN REVIEW

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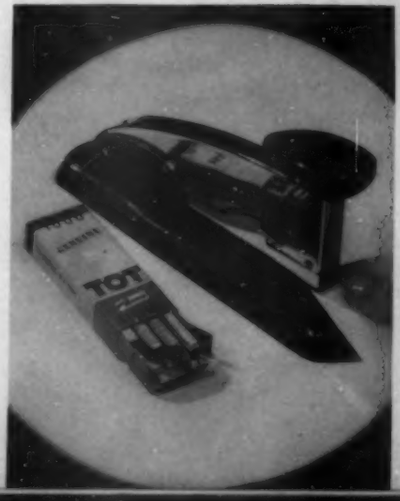

13. Undercuts for the L-shaped slots and threaded brass inserts were molded right into this bayonet-type socket unit by Auburn Button Works. Bakelite is the material

14. These Schenley advertising charms are injection molded of cellulose acetate by the Universal Plastics Corporation. After being molded in strips, the charms are broken apart and attached to liquor bottles

15. "Tot" is the new stapler announced by the Parrot Speed Fastener Corp. Small, lightweight and strong, it has a Durez base and striker, molded by the American Insulator Corp., fitted to the metal parts

16. Displays mounted on the turntable of this revolving display base are slowly turned by a small electric motor concealed in the molded Bakelite housing. Waterbury Button Co. did the molding

Manufacturers' addresses will be sent if you will write to the Editor, enclosing 3-cent stamp for reply

PHOTO COURTESY NEW YORK MUSEUM OF SCIENCE AND INDUSTRY

Dr. S. Theo Jonas, originator of the new technique in visual education, takes apart his book on the evolution of the world to show how the pages of Monsanto Vue-Pak are superimposed on each other to present a complete pictorial sequence. Artists paint original scenes on the pages, which are then reproduced by the Offset Gravure Company

LATEST AID TO EDUCATION

Page by page the transparent book builds up a complete pictorial sequence on sheets of cellulose acetate

A BOOK THAT TAKES A PICTURE APART AND puts it together again; that, bit by bit, builds up a visualization of a scene, an object or an idea and then disassembles it, is the latest aid to education and merchandising. With it, new ways of presenting a subject and more dramatic selling methods are possible.

The principle of the book is simple enough, but the ingenious way in which it has been worked out is new.

It consists of a number of leaves of transparent cellulose acetate, bound together in book form with a spiral binding. Each leaf has printed, drawn or painted on it one or more elements of a complete picture. As the leaves are turned, the individual elements are superimposed one on the other, and the picture is complete. In some subjects, the back of each page has a different view drawn within the same outline. Turning the leaves from back to front reveals a different picture relative to the same subject, such as internal construction, or pathological or physical views of the picture seen on the opposite sides.

Dr. S. Theo Jonas, Dean of the National School of Mechanical Dentistry, the inventor of the transparent book says that the idea came to him while a student of surgery in Vienna. Not knowing the language in which the lectures were given, he would sketch each step in the professors' demonstrations. The leaves in his notebook were so thin that he could see through one page onto the sketch preceding, giving a superimposing effect. From this he conceived the idea of a book made entirely of a transparent material.

"The transparent book would not be possible without a plastic," says Dr. Jonas. "Not only does it have the needed crystal clarity, but it may be washed or sterilized with antiseptic solutions. It may even be eaten by children without harm."

The idea has been applied to a great many different subjects. From anatomy to (*Please turn to page 58*)

LIGHT WITHOUT GLARE

by JOHN E. ALCOTT*

Polaroid strains the harshness out of desk illumination

WHILE THE POLARIZATION OF LIGHT IS AN OLD story in the laboratory and is a familiar property of certain natural crystals it was not until the invention of Polaroid by Edwin H. Land that the extraordinary advantages of polarized light could be enjoyed by the average man. Polaroid itself is a cellulose film in which are imbedded microscopic synthetic crystals. Polarization is, in effect, the "combing out" from each light ray all of the vibrations except those in a single plane. In the case of the Polaroid Desk Lamp only the vertical vibrations are permitted to pass. It is these vibrations that carry the visual message of hills and valleys in the surface, that give the sensations of color and of light and dark. The other vibrations, particularly the horizontal, convey little of the wanted image and produce nearly all of the glare or highlights. These unwanted vibrations are imprisoned within the lamp.

The design of the lamp is quite functional, the points of optical importance having been positively determined before appearance was considered. The position of all edges against the light; the relations of light source to desk top and the relative positions of bulb, reflector and polaroid were all critical and to be maintained. The matter of air space and circulation is also important in any enclosed fixture with a bulb of even moderate wattage. Air enters the lamp through holes in its floor as well as through the louvred back, moves up around the bulb, expands and circulates in the dome of the top and makes its exit through the top of the back. A reflecting shield turns back direct heat sent up from the bulb and keeps the top at a temperature only a little above that of the room.

The inside was at least as carefully planned as the outside and everything has been done to assure quick, easy assembly and convenient bulb replacement by the owner. Probably no other comparable lamp (not even a pocket flashlight) can approach this in simplicity, in economy of means or in ease and certainty of assembly. The polaroid film is held, at the back by two molded blocks and at the top and bottom by slip-in wire clips. The socket and switch may be assembled outside the lamp and slid in a groove into their exact positions. The reflector is held clear of the back and accurately positioned by molded-in buttons and a single telescoping screw. The back is held by two thumb screws and may be removed without tools and the bulb replaced without the possibility of disturbing any of the nice adjustment of parts. Simple directions for doing this are molded in a panel on the back. Should any change in bulb design occur in the future it will be necessary to replace only the socket (a standard part) with another of different proportions to accommodate the lamp to the new bulb.

As the front of the lamp is entirely on a plug in the bottom of the mold this part (*Please turn to page 74*)

* Alcott, Thoner & Marsh, Designers

The Polaroid Desk Lamp (below, left) designed by Alcott, Thoner and Marsh, bears a strange relationship to conventional lighting units. It is designed to meet severe optical requirements for desk illumination and the molded Bakelite housing serves both as an insulator and a shade. No, the parts at the right are not the result of an explosion. They illustrate the simple assembly units

COLOR

by E. J. BOCCHICCHIO*

THE SOURCE OF ALL COLOR IS LIGHT; WITHOUT light, natural or artificial, there can be no color. Everything we can see is visible either because (a) it is self-luminous, like the sun, stars, or an electric light; or because (b) it reflects the light which falls upon it from some luminous source. The brightest self-luminous body is the sun, which gives us what we suppose is white light of day. This white light we might readily suppose to be quite simple in its own composition; actually it is made up of rays of all the colors the human eye can see.

Color, therefore, primarily is a sensation resulting from the action of light on the nerve centers of the eye. In order to produce this sensation, two factors are necessary: first, light; and, second, some substance which has the faculty of breaking up light into the spectrum, thus reflecting some of these colors and absorbing others. Without light there can be no color. Therefore, when we say an object is "black," it is another way of saying that all sources of light are being absorbed. In contrast, if we see an object which appears "white," it reflects all sources of light striking it. Possibly the best example of reflection and absorption of light is found in the rainbow. When we say that we are looking at that part of the rainbow which appears "red," it simply means that we are looking at a substance which has the make-up of absorbing all but the "red" rays, and these are reflected.

Color has three qualities, namely, Hue, Value, and Chroma. *Hue* is that quality by which we distinguish one color from another, as red from green, or blue. True as this may be, it does not tell us whether this color is light or dark, weak or strong; therefore, we must look to Value and Chroma for these qualities.

Value is that quality by which we distinguish a light color from a dark one, that is, assuming that we use the extremes "white" and "black" as a scale, the degree of light present in a color to produce a light Value, or the degree of light in a color to produce a dark color Value. Color values are loosely called "tints" and "shades," but these terms are misapplied frequently. A tint is pure color with white added, and a shade is a pure color with black added. Too often is the word "shade" used in describing Hue.

Chroma is that quality by which we distinguish a strong color from a weak one, or its power of stimulating the color sense organs. Colors which have this stimulating capacity in a high degree will be those which are furthest removed from neutral gray, or a relatively pure color, pure because of its freedom from grayness. Therefore, we may change the intensity of a color without changing its tone by mixing it with a neutral gray of the same tone as the color itself. Loss of Chroma is what we term fading, but this word is frequently used to include changes of Value and Hue. If we were to make comparisons of two pieces of colored material by exposing one to weather while the other is protected, soon the exposed piece would fade into a grayish color, while the other piece retains its strong Chroma almost intact. If, in fading, the color does not change in Hue or Value, there obviously is only a loss in Chroma.

Colors differ as regards their force. Some are active, forceful, and advancing. Others are passive, timid, and receding. To test the activity of colors, place a piece of colored material, as yellow, orange, pure red, blue, green, and violet, at a distance of ten or twelve feet. It will be evident that the orange and pure red are decidedly more advancing than the others. These are known as the warm colors. In comparison, the blue, green, and violet, known as the cool colors, are relatively receding.

In formulating a good color scheme, it is important that it has the proper balance in cool and warm colors. They should be neither flushed nor cold. The color combinations should be both agreeable to the eye, as well as to the mind. It must be practical in a sense that colors must be suited to their purpose. The colors must be adapted to the material, as well as to its construction. This may better be termed "fitness."

When a good color scheme has been established, the safest and simplest solution for the use of hues in harmony is through "self tones" of one color, or monochromatic harmony. Monochromatic harmonies make attractive settings, but particular care must be given so that no two tones of the same hue follow one another. This condition may be easily altered by inserting a second tone to produce a contrast. One may carry this step further by the introduction of related hues.

Related hues are those colors which adjoin one another in the spectrum. For example, hues related to yellow are yellow-green, orange-yellow, and red-violet. Those related to violet are blue, blue-violet, and red-violet, etc.

A scheme of self tones is weak in one respect. It will be found that the colors are either all warm or all cold, all active or all passive. The introduction of related hues hardly improves this weakness as they are very much alike in this respect. (*Please turn to page 58*)

*Color Engineer, Westinghouse Electric and Manufacturing Co.

STOCK MOLDS

SHEET SEVENTY-ONE

Novelty dress adornments and radio knobs in various sizes and shapes are available without mold cost from stock molds. Names and addresses of the molders will be supplied upon request

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Reprints of sheets One to Fifty-Two are available in book form. Twenty-five cents in coin or stamps

763–769. These dress ornaments are supplied in a variety of pastel colors. Pins or clips may readily be attached to them by drilling. They are of urea material and are available in the forms shown here

772. Radio knob, 1 in. diameter with hole for attachment

773. Radio knob, 7/8 in. diameter with spring clip for attachment

774. Radio knob, 3/4 in. diameter, with spring clip for attachment to shaft

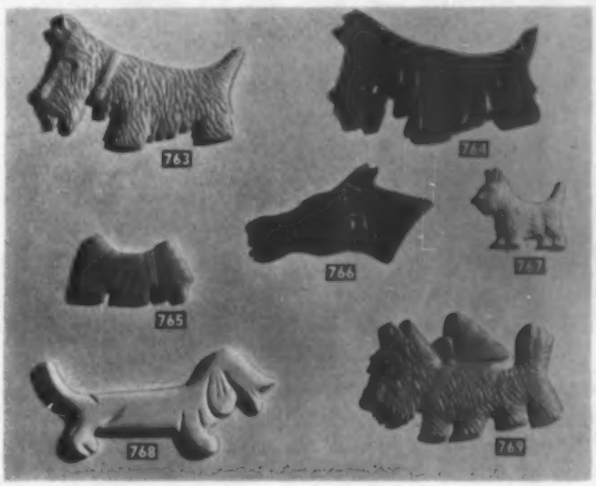
775. Bullet type radio control knob. It is 3/4 in. in diameter with side opening for set screw

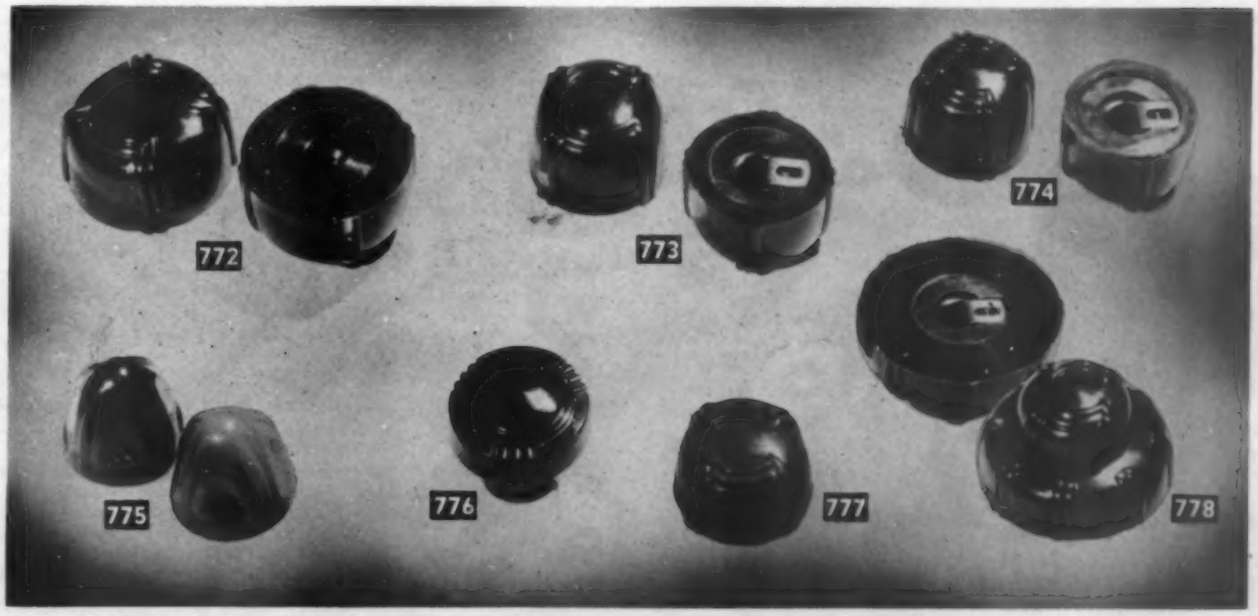
776. Radio knob, diameter on face 1 in. The same style knob is also available with a 7/8 in. face

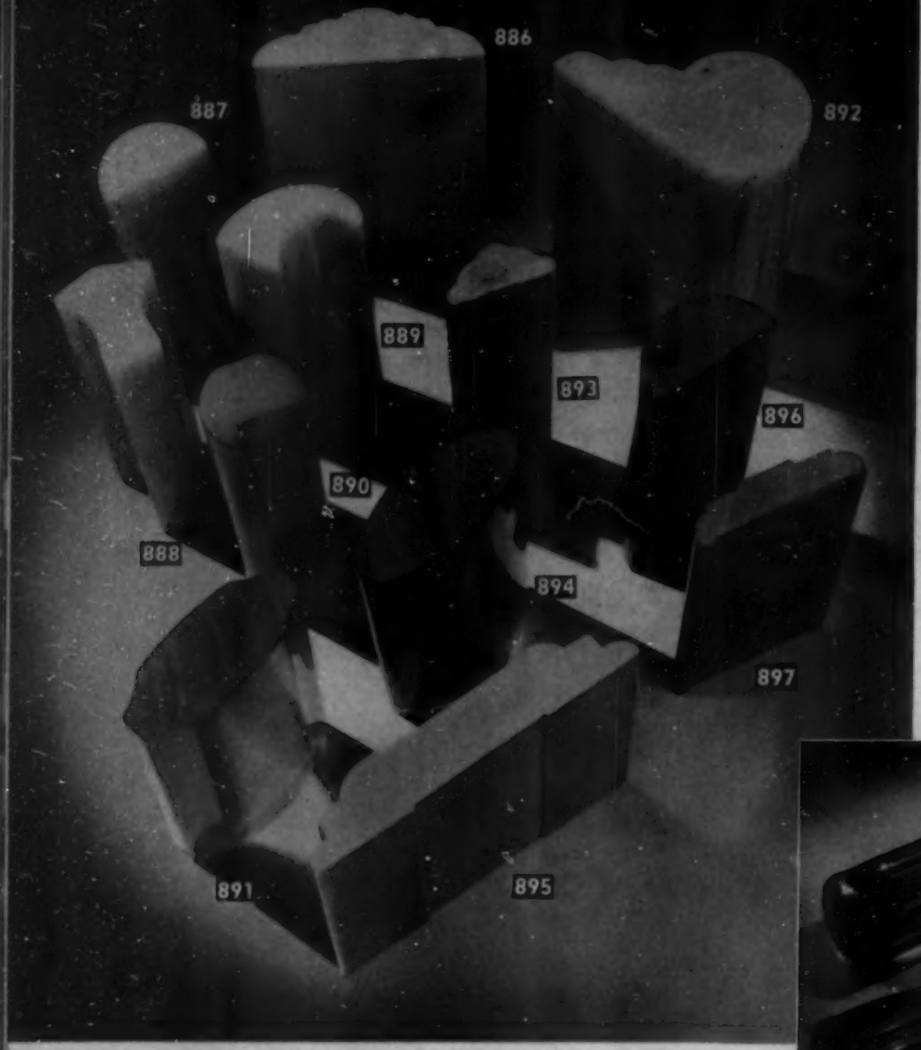
777. Radio knob, 3/4 in. diameter with flutings on top section

778. Radio knob 1 3/8 in. diameter with spring clip

Address all inquiries to Stock Mold Department, Modern Plastics, Chanin Building, N. Y. C. All molders are invited to send samples from stock molds to appear on this page as space permits







CAST RESIN FORMS

SHEET SEVENTY-TWO

The forms shown at the left are supplied in various lengths and weights in the cross sections shown. They are fabricated into finished articles by sawing or slicing, followed by buffing and polishing. The screwdriver handles are supplied in the forms shown below. They are swaged onto screwdrivers by heat

Address all inquiries to Stock Mold Department, Modern Plastics, Chanin Building, N. Y. C. All molders are invited to send samples from stock molds to appear on this page as space permits

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881. Screw driver handle, 4 1/2 in. long and approximately 1 1/8 in. in diameter at the large end. These come 5 3/4 pieces to the pound

882. Screw driver handle, 2 3/4 in. long about 1 in. in diameter. 15 pieces to the pound

883. Screw driver handle 2 1/2 in. long, 3/4 in. diameter. 23 1/2 pieces to the pound

884. Screw driver about 2 in. long and 1/2 in. diameter. 70 pieces to the pound

885. Decorative end piece about 2 in. long, 1 in. wide and 3/4 in. high

886. Bag frame 2 in. wide in forms 10 1/4 in. long that weigh .37 pound

887. Half round 1 in. diameter in forms 11 7/8 in. long weighing .22 pound

888. Drawer pull 3/4 in. at the widest point. Supplied in forms 12 in. long that weigh .27 pound

889. Drawer pull 5/8 in. wide at the base in forms 6 3/4 in. long weighing .16 pound

890. Drawer pull 3/4 in. at its longest diameter in forms 12 in. long that weigh .27 pound

891. Pull bar 1 3/4 in. across in forms 16 in. long weighing .78 pound

892. Fender guide 1 1/2 in. across the flat side in forms 16 in. long that weigh 1.3 pound

893. Drawer pull about 1 in. wide in 12 in. forms that weigh .27 pound

894. Oval shape 1 5/8 in. wide supplied in forms 16 in. long weighing .78 pound

895. Bag frame 3 in. across in forms 10 1/4 in. long weighing .66 pound

896. Half round 1 1/4 in. diameter, in 12 in. forms weighing .38 pound

897. Bag frame 1 1/2 in. wide in forms weighing .22 pound that are 10 1/4 in. long

Reprints of sheets One to Fifty-Two in book form, 25c in coin or stamps

CENSUS OF PLASTICS

MANUFACTURERS OF PRODUCTS MADE OF PLASTICS and vulcanized fiber reported a considerable increase in the number of wage earners, and large increases in wages, and value of products for 1937 as compared with 1935, according to preliminary figures compiled from the returns of the recent Biennial Census of Manufacturers, released by Director William L. Austin, Bureau of the Census, Department of Commerce.

The number of wage earners increased 30.8 percent, from 12,749 in 1935 to 16,673 in 1937 while their wages increased 64 percent, from $12,090,086 to $19,822,100. The value of products increased from $50,298,937 in 1935 to $77,715,723 in 1937, a gain of 54.5 percent.

This industry, as classified for Census purposes, embraces establishments engaged primarily in the manufacture of products made of synthetic resins, cellulose compounds, casein or galalith, vulcanized fiber, and molded or pressed pulp, except those making articles from such materials whose products are separately classified as "Buttons," "Brushes, other than rubber" (tooth and other toilet brushes).

Table 1 gives summary statistics for 1937, 1935, and 1933 and table 2 shows the production, by kind and value, for 1937 and 1935. 1937 figures are preliminary.

TABLE 1—SUMMARY FOR THE INDUSTRY: 1937, 1935, AND 1933 (Because they account for a negligible portion of the national output, plants with annual production valued at less than $5000 have been excluded since 1919)

	1937	1935	1933	Per Cent of Increase	
				1935–1937	1933–1937
Number of establishments	160	153	101	4.6	58.4
Wage earners (average for the year)[1]	16,673	12,749	6,840	30.8	143.8
Wages[2]	$19,822,100	$12,090,086	$5,926,897	64.0	234.4
Cost of materials, supplies, containers, fuel, and purchased electric energy[2]	$32,044,670	$21,240,873	$10,023,281	50.9	219.7
Value of products[2]	$77,715,723	$50,298,937	$25,731,321	54.5	202.0
Value added by manufacture[3]	$45,671,053	$29,058,064	$15,708,040	57.2	190.7

1—Not including salaried officers and employees. Data for such officers and employees will be included in a later report. The item for wage earners is an average of the numbers reported for the several months of the year. In calculating it, equal weight must be given to full-time and part-time wage earners (not reported separately by the Manufacturers), and for this reason it exceeds the number that would have been required to perform the work done in the industry if all wage earners had been continuously employed throughout the year. The quotient obtained by dividing the amount of wages by the average number of wage earners cannot, therefore, be accepted as representing the average wage received by full-time wage earners. In making comparisons between the figures for 1937 and those for earlier years, the possibility that the proportion of part-time employment varied from year to year should be taken into account. 2—Profits or losses cannot be calculated from the Census figures because no data are collected for certain expense items, such as interest, rent, depreciation, taxes, insurance, and advertising. 3—Value of products less cost of materials, supplies, containers, fuel, and purchased electric energy.

TABLE 2—PRODUCTS, BY KIND AND VALUE: 1937 AND 1935 (No comparable statistics are available for 1933)

	1937	1935
1. "Synthetic-Resin, Cellulose-Plastic, Vulcanized-Fiber, and Molded and Pressed Pulp Fabricated Articles, not Elsewhere Classified" industry, all products, total value	$77,715,723	$50,298,937
2. Fabricated articles of synthetic resin, nitrocellulose, cellulose acetate, transparent cellulose sheeting, vulcanized fiber, and wood pulp	73,037,371	46,966,309
3. Other products (not normally belonging to the industry)	4,678,352	[3]3,332,628
4. Fabricated articles of synthetic resins, etc., made as secondary products in other industries	([2])	7,996,148
Fabricated articles of synthetic resins, etc., total value (sum of 2 and 4)	[3]73,037,371	54,962,457
Synthetic-resins (phenolic urea, vinyl, acrylate, etc.):		
Laminated products:		
Sheets, plates, blocks, rods, tubes, and blanks	12,588,713	4,767,616
Gears, bearings, and other machine parts	2,765,009	5,912,006
Electrical goods	1,233,868	
Other and not specified	4,251,736	
Molded or cast:		
Electrical goods	6,692,804	23,304,135
Closures	2,962,312	
Battery boxes	2,625,632	
Housings (for cameras, scales, radios, etc.)	1,235,769	
Cigarette cases, compacts, vanity cases, and similar articles	764,075	
Other and not specified	14,531,304	
Cellulose compounds (nitrocellulose, cellulose acetate, etc.)—Housings (for radios, etc.), cigarette cases, compacts, vanity cases, and similar articles, and those not specified	5,867,839	8,534,474
Vulcanized fiber:		
Rods, tubes, and other unfinished forms	2,948,657	4,718,844
Hollow ware (boxes, cans, pails, etc.)	1,975,623	1,044,749
Laminated sheets and plates	4,767,728	2,389,313
Other and not specified	1,918,776	
Molded pulp products (dishes, egg-case liners, etc.)	4,196,621	4,291,320
Fiber conduits and fittings	1,710,905	

1—Includes a small amount received for custom work. 2—Not yet available; will be shown in final report. 3—Incomplete; see footnote 2.

ELECTRICAL PROPERTIES OF ETHYL CELLULOSE FILMS AND PLASTICS*

By SHAILER L. BASS** and W. C. GOGGIN***

RECENT DEVELOPMENTS IN THE MANUFACture of films and plastics from ethyl cellulose are attracting considerable attention to these interesting new materials. Their commercial availability has resulted from the unstinting effort of domestic manufacturers[1] in the production of high quality ethyl cellulose and in the development of its uses.[2] A scientific rarity twenty-five years ago,[3] ethyl cellulose is now a standard article of commerce[1,4] and, because of its versatility, bids fair to assume an increasing importance in the field of plastics.[3,5]

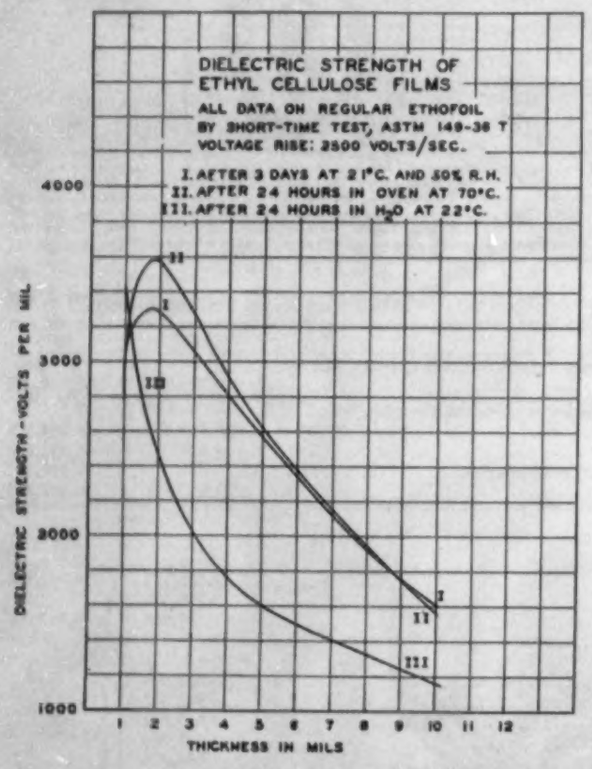
Ethyl cellulose film has recently been added to the transparent foils available for wrapping purposes. The data of Table I show that it combines an excellent toughness and flexibility with good electrical properties. It does not shrink or curl on aging, or on exposure to wide variations in temperature and humidity. Ethyl cellulose film retains its flexibility after more than 200 hours in the Fadeometer or after heating six months at 70° C. Its low loss factor, high resistivity and low moisture absorption make it interesting as an insulating foil. It is one of the lightest of the commercially available foils, due to its relatively low density of 1.14. Since the high flexibility of ethyl cellulose film is an inherent property of the material itself, the film, is furnished in a regular type which contains no plasticizer. Its unusually

TABLE I.—PROPERTIES OF ETHYL CELLULOSE FILM
All data on 0.001 in. (0.025 mm.) regular, not moistureproofed, Ethofoil* at 25° C.

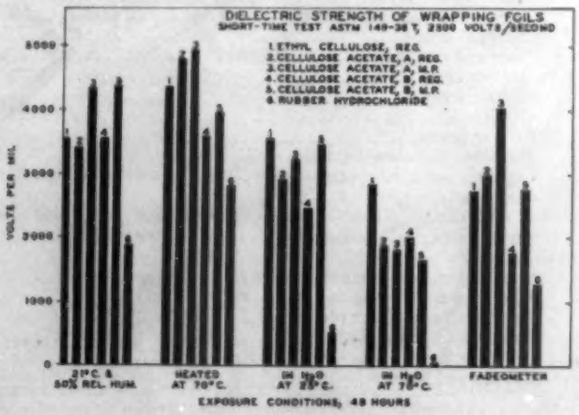
Density		1.14
Square inches per pound		24,000
Square meters per kg		34,000
Tensile strength	lb./sq. in.	10,000
	kg./cm.²	700
Elongation		30%
Refractive index		1.47
Transmission of white light		94%
Ultraviolet absorption, complete below		2,150 A
Yellowing after 200 hours in Fadeometer		None
Embrittlement after 200 hours in Fadeometer		None
Moisture permeability, g./sq. m./24 hr		1,200
Moisture absorption, 70° F. (21° C.) and 90% rel. humidity		0.8–1.2%
Dielectric constant	60 cycle	3.2
	1,000 cycle	3.0
	1,000,000 cycle	2.7
Power factor	60 cycle	0.0135
	1,000 cycle	0.004
	1,000,000 cycle	0.02
Resistivity, ohm centimeters		0.3–1.0 × 10^{14}
Dielectric strength volts		3000–3500

* Trade name for Dow ethyl cellulose film.

1


DIELECTRIC STRENGTH OF ETHYL CELLULOSE FILMS
ALL DATA ON REGULAR ETHOFOIL
BY SHORT-TIME TEST, ASTM 149-38 T
VOLTAGE RISE: 2500 VOLTS/SEC.
I. AFTER 3 DAYS AT 21°C. AND 50% R.H.
II. AFTER 24 HOURS IN OVEN AT 70°C.
III. AFTER 24 HOURS IN H2O AT 22°C.
DIELECTRIC STRENGTH - VOLTS PER MIL
4000
3000
2000
1000
1 2 3 4 5 6 7 8 9 10 11 12
THICKNESS IN MILS

2



* Abstracted from a paper (Preprint 74-36) presented at the Symposium on Plastics held by the Electrochemical Society at Rochester, N. Y., on October 13, 1938.

** Dow Chemical Company, Cellulose and Plastics Division, Midland, Michigan.
*** Dow Chemical Company, Physical Research Laboratory, Midland, Michigan.

1. (a) Dow Chemical Company, "Ethocel," 1937; "Plastic Materials and Plasticizers," 1938. (b) Hercules Powder Company, "Ethyl Cellulose," 1937.
2. (a) D. R. Wiggam, Modern Plastics, **14**, 31 (1936); (b) J. M. DeBell, Chem. & Met. Eng., **44**, 31 (1937); (c) W. Koch, Ind. Eng. Chem., **29**, 687 (1937).
3. (a) W. Suida, Monatsh., **26**, 410 (1905); (b) L. Lilienfeld, Brit. Pat. 12,584 (1912); U. S. Pat. 1,188,376 (1916); (c) O. Leuchs, Ger. Pat. 322,586 (1920); (d) H. Dreyfus, French Pat. 462,274 (1914).
4. U. S. Navy Bureau of Aeronautics Specification RM-4.
5. D. L. Gibb, Modern Plastics, **15**, 23 (1937).

fortunate combination of physical, mechanical and electrical properties made a more detailed study of its dielectric properties desirable and valuable.

Effect of film thickness on dielectric strength

The dielectric strength of ethyl cellulose film over the range of thickness commercially available is shown in Fig. 1. The breakdown voltages[6] of films which had been conditioned three days at 21° C. and 50 per cent relative humidity are shown in Curve I. The effect of heating the films 24 hours at 70° C. is shown in Curve II. The slightly higher dielectric strengths result from driving out the small amount of moisture absorbed in the films. On immersing the films 24 hours in water at 22° C., the dielectric strength is considerably reduced in the thicker films as Curve III shows. Films showed no appreciable increase in thickness due to water absorption.

Dielectric strength of wrapping foils

A comparison of the breakdown voltage of several commercial wrapping foils, all about 0.001 in. (0.025 mm.) thick, is shown in Fig. 2. The films studied were those whose properties might lead to a consideration of their use as dielectrics. Ethyl cellulose film is compared with two varieties of cellulose acetate film, each plain and moisture-proofed, and with rubber hydrochloride. The figure graphically presents the average breakdown voltage for each film under five different conditions. Heating the films to 70° C. for 48 hours and testing before they had reabsorbed moisture produced a marked increase in dielectric strength in all films except those of cellulose acetate, B. Exposure for 48 hours in the Fadeometer reduced the dielectric strength of the films comparatively little with the exception of cellulose acetate, B. The difference in behavior of the two varieties of cellulose acetate on exposure to light is probably due to the different sensitivity of their respective plasticizers.

Effect of water on wrapping foils

The severest effects on dielectric strength were noted on immersing the films in water. After 48 hours immersion in water at 25° C., the dielectric strength of the ethyl cellulose film remained unchanged. Both forms of the two acetate films showed about the same decrease in dielectric strength after this exposure. The rubber hydrochloride film lost practically all its original resistance to high-voltage breakdown.

After 48 hours in water at 70° C., the acetate films showed a reduction in dielectric strength which is greater than half their original value. The rubber hydrochloride film failed completely, but the ethyl cellulose film

6. Am. Soc. Testing Materials, D 149-36 T. The short-time dielectric strength test with a voltage rise of 2,500 volts per second was used.

3

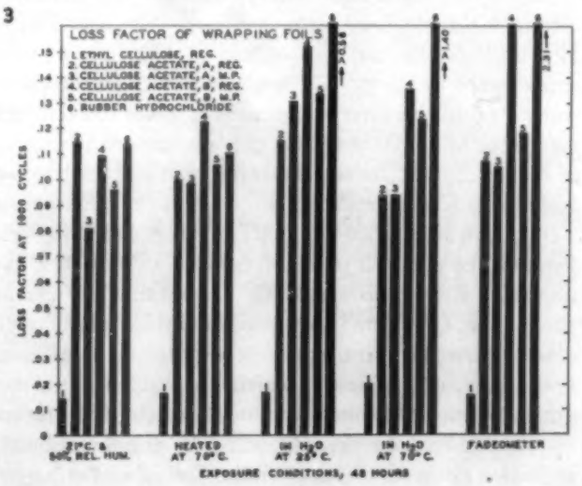
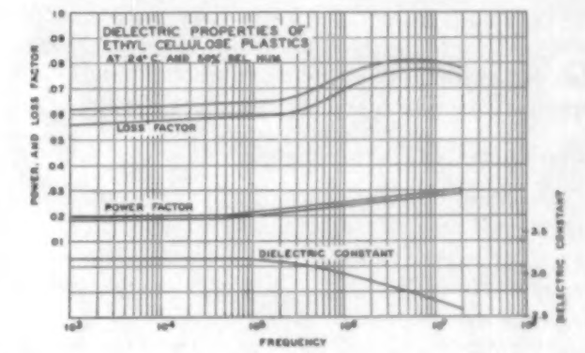


Table II.—Weight Change of Wrapping Foils on Immersion in Water

Foil Type	Percentage Change in Weight on Immersion in Water 48 Hours	
	at 25° C.	at 70° C.
Ethyl cellulose reg.....	+ 1.5	+ 4.8
Cellulose acetate A, reg.....	−19.0	−18.6
Cellulose acetate A, m. p.....	−15.2	−17.5
Cellulose acetate B, reg.....	− 2.1	−11.9
Cellulose acetate B, m. p.....	− 1.3	− 4.3
Rubber hydrochloride.....	+18.8	+23.0

4



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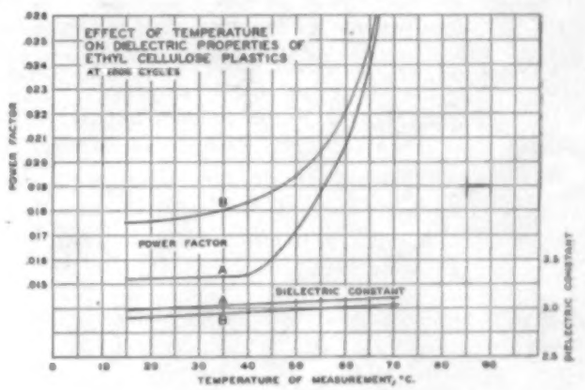

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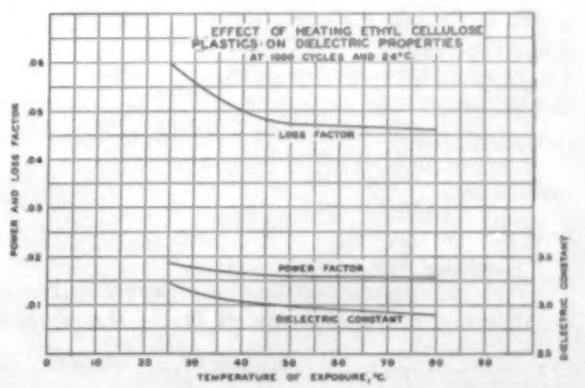

EFFECT OF HEATING ETHYL CELLULOSE PLASTICS ON DIELECTRIC PROPERTIES AT 1000 CYCLES AND 24°C.
LOSS FACTOR
POWER FACTOR
DIELECTRIC CONSTANT
POWER AND LOSS FACTOR
DIELECTRIC CONSTANT
TEMPERATURE OF EXPOSURE, °C.

retained about three-fourths of its original resistance to breakdown. The percentage change in weight of the films after immersion in water is shown in Table II. The weight change of the ethyl cellulose films on immersion in water is due entirely to water absorbed, since the films contained no plasticizer. The loss in weight of the cellulose acetate films probably resulted from leaching out the plasticizer. The film of rubber hydrochloride turned white on contact with warm water, the acetate films became cloudy, but the ethyl cellulose film remained clear.

Loss factor of wrapping foils

The dielectric constant and power factor at 1000 cycles were determined on the commercial wrapping foils listed in Table II, after the same series of exposure conditions used in obtaining the data of Fig. 2. The loss factor, the product of dielectric constant and tangent loss angle, of each of the films after the various exposures is shown in Fig. 3. The loss factor of ethyl cellulose film is seen to be from 7 to 10 times lower than the acetate films under the various exposures used. Immersing the rubber hydrochloride film in water readily transforms it to a material which is worthless as a dielectric.

Uses of ethyl cellulose film

The dimensional stability of ethyl cellulose films and their good retention of insulating qualities on exposure to water, light and heat indicate their utility as a primary insulation for electric motors, and other low voltage insulation where cellulosic materials are now being used. When laminated to paper now used for insulation, the film does not prevent moisture absorption by the paper but does provide a barrier to the passage of low voltage currents through the paper. In addition, the toughness and flexibility of ethyl cellulose films make them useful as a wrapping tape for fine wires and bars in transformer insulation. The thermoplasticity and insolubility of ethyl cellulose in mineral oils makes possible the fusion of such wrapped insulation to a homogeneous single continuous covering by immersing the piece in a heated oil bath under pressure.

Electrical properties of ethyl cellulose plastics

The dielectric properties of ethyl cellulose plastics are affected by the kind of plasticizer or other material added to the ethyl cellulose. Hence, the following figures for power factor and dielectric constant necessarily define a range of values.

Dielectric strength,[7] volts/mil		1,500
Dielectric constant	1,000 cycle	2.9–3.3
	1,000,000 cycle	2.7–3.0
Power factor	1,000 cycle	1.0–2.5%
	1,000,000 cycle	0.5–2.75%
Resistivity, ohm centimeters		0.3–1.0 × 10^{14}

The dielectric constant of the plastic is very little different than that of the unplasticized film. The power factor of the plastic is higher than that of ethyl cellulose film, due to the plasticizer present in the former.

A study was made of the dielectric properties of two ethyl cellulose plastics with changes in current frequency, temperature and after immersion in water. The plastics chosen were typical injection molding materials having the composition and properties shown in Table III.

Table III.—Properties of Ethyl Cellulose Plastics Used for Electrical Tests

Ethyl Cellulose Plastic	Plasticizer Content in Percent of Ethyl Cellulose		Temperature for Uniform Flow (c)		Heat Distortion Temp. (e)		Impact Strength Ft. lb. (d)	Rockwell Hardness Number (f)
	Dow No. 6 (a)	Dow No. 7 (b)						
A	12	4	260°F.	127°C.	120°F.	49°C.	8.0	65
B	15	5	265°F.	129°C.	120°F.	49°C.	6.8	64

(a) Di-(o-xenyl) mono phenyl phosphate, U. S. Pat. 2,033,918; 2,124,540.

(b) Tri (p-tert. butylphenyl) phosphate, U. S. Pat. 2,071,323.

(c) Method of Penning and Meyers, Am. Soc. Testing Mat. Symposium on Plastics, p. 26 (1938).

(d) Ft. lb. to break Izod notched bar in Am. Soc. Testing Mat., D 256-34 T at 70° F. (20° C.) and 50 percent relative humidity.

(e) Am. Soc. Testing Mat., D 48-37.

(f) Rockwell tester, using 1/2 in. (12.5 mm.) ball, 60 kg. load.

Variation with frequency

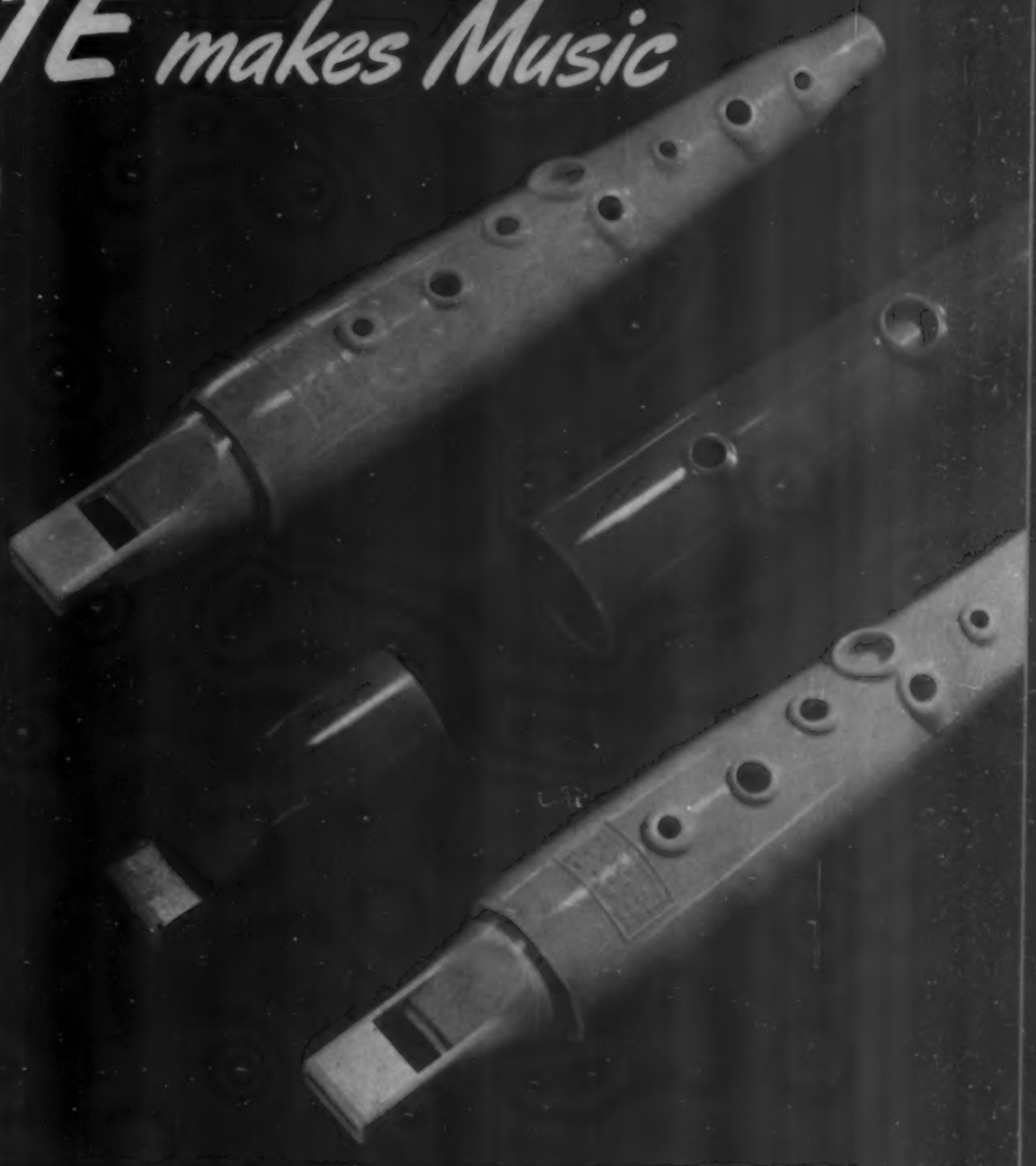
The variation with frequency of the dielectric constant and power factor of the two ethyl cellulose plastics, equilibrated at 50 percent relative humidity, is shown by the curves of Fig. 4. The dielectric constant remains practically constant with frequency up to about 10^5 cycles after which it decreases. The power factor curve has a very slight slope up to 10^5 cycles and shows a slight increase at higher frequencies. The loss factor curve, which expresses the product of the tangent of the loss angle by the dielectric constant, exhibits a somewhat similar behavior. Ethyl cellulose plastics have a loss factor over the range of frequency studied which is low compared to most molded materials now in use.

Variation with temperature

The variation of dielectric properties with temperature of measurement is shown by the curves of Fig. 5. The dielectric constant increases only slightly with temperature up to 75° C., but the power factor curves show a rapid rise after about 40° C. Over the temperature range of 15° C. to 65° C., this amounts to an increase of 62 per cent. The temperature range at which power factor begins to increase coincides with the beginning of a change in state since the A.S.T.M. heat distortion temperature for the two plastics is about 50° C. The data on which the curves are based was obtained by placing the 0.10 in. (2.5 mm.) compression molded sheets of the plastic between two 0.35 in. × 1 1/2 in. (9 × 38 mm.) brass discs, one of which carried a thermocouple well which permitted temperature measurement near the center of one face of the plastic. The whole assembly, including electrodes, was heated (*Please turn to page 74*)

7. At 60 cycles, using 0.236 in. (6 mm.) electrodes and 0.010 in. (0.25 mm.) thickness of test piece.

TENITE makes Music



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Plastics Digest

This digest includes each month the more important articles (wherever published) which are of interest to those who make plastic materials or use them

General

A PLASTICS REVIEW. G. Dring. Chem. and Ind. (London) *57*, 1159–61 (Dec. 10, 1938). A discussion of progress in the plastics industry during 1938, particularly as set forth in articles by various English authors.

FUNDAMENTALS OF GLASSINE TRANSPARENCY. D. B. Wicker. Paper Trade J. *105*, 31–40 (Oct. 21, 1937); *107*, 44–52 (Oct. 27, 1938). The first paper considers the psychological aspects of transparency and the second covers the experimental measurement of this property. The capacity for transmitting rays of light without scattering is concluded to be the single property which dominates all others in determining transparency. A transparency meter is described.

PHYSICS AND THE PLASTICS INDUSTRY. W. G. Wearmouth. Chem. and Ind. (London) *57*, 1176–82 (Dec. 17, 1938). This is a review of physical principles involved in the testing of plastics. The subjects of elasticity, plasticity, softness, and softening point are especially emphasized. The author notes that there is a dearth of fundamental information on these properties of plastics. Discussion of this paper appears in the same journal *57*, 1037 (Oct. 29, 1938).

MOLDED PLASTICS: SELECTING THE MATERIAL AND DESIGNING THE PART. C. W. Blount. Product Eng. *9*, 462–5 (Dec. 1938). The properties of phenolic, urea, cellulose acetate, and polystyrene plastics are compared by means of diagrams and tables. Cf. Plastics (London) *2*, 410–11 (Dec. 1938).

Materials and Manufacture

VINYL ESTERS: THEIR ORIGIN, TRANSFORMATION, AND APPLICATIONS. F. W. Skirrow. Chem. and Ind. (London) *57*, 1117–23 (Nov. 26, 1938). Personal experiences in the industrial development of the vinyl resins, beginning in 1919, are related. The important part which careful observations of unexpected experimental results in the laboratory play in bringing new products from the test tube to successful plant production is strikingly told.

SOME NON-THERMOPLASTIC PRODUCTS FROM CELLULOSE. K. Sponsel. Kunststoffe *28*, 321–3 (Dec. 1938). The properties and uses of viscose products, methyl cellulose, and various alkali-soluble, water-insoluble cellulose ethers are described.

PREPARATION OF FOILS FROM THERMOPLASTIC POLYMERS. W. Schlitt. Kunststoffe *28*, 317–9 (Dec. 1938). Improvement of the properties of the transparent sheets is obtained by heating and stretching.

LAC RESEARCH: ANNUAL REPORT OF THE LONDON SHELLAC RESEARCH BUREAU. Chem. Age (London) *39*, 407–8 (Nov. 26, 1938).

RECENT INVESTIGATIONS ON SHELLAC. A. J. Gibson and R. Bhattacharya. Chem. Age *39*, 467–8 (Dec. 17, 1938). Results of recent researches on shellac are reviewed in this and the preceding reference. A technic for dry hot spraying of lac on to surfaces, such as porcelain, plaster, wood, paper, and metals is described. The coating is claimed to be more resistant to water and harder than a varnish film, but inferior in flexibility because it has not been possible yet to produce a film thinner than 0.1 mm.

IGELITES. F. Chevassus. Rev. Gén. Mat. Plastiques *14*, 298–302 (Nov. 1938). This is the first of a series of articles on the preparation and plasticization of vinyl chloride resinous products marketed under the trade name "Igelite."

Molding and Fabricating

NEW MACHINES FOR THE PREPARATION OF COMPRESSION AND INJECTION MOLDS. Fr. Olk. Kunststoffe *28*, 313–7 (Dec. 1938). Electrically operated machines to copy dies are described and illustrated.

DESIGN OF INSERTS FOR MOLDED PLASTICS PARTS. F. W. Warner and R. R. MacKenzie. Product Eng. *10*, 28–9 (Jan. 1939). Inserts are classified as (1) rod or wire inserts, (2) inserts with male threads, (3) inserts with female threads, (4) spun-over type inserts, (5) stamped or punched inserts, and (6) miscellaneous. These are illustrated and the various factors to be considered in their design are cited.

Applications

PROGRESS IN THE RESIN FINISHING OF TEXTILE FABRICS. D. H. Powers. Am. Dyestuff Rep. *27*, 688–9 (Nov. 28, 1938). The year 1938 saw a steady increase in the use of urea-formaldehyde and acrylate resins in the textile industry. Some of the more important effects which they have produced are anti-creasing, printing with the resins as binders for pigments, stabilizing the fabric against stretching or shrinking, and finishing. In low concentration they offer an improved finish at comparable costs and in high concentration they impart to the fiber and fabric new and frequently unique characteristics—greater elasticity, strength, luster, resilience, toughness, and stability. We may consequently expect their use to grow and widen during 1939 in the production of more permanent finishes and the development of new and novel fabrics from natural or synthetic fibers.

CELLULOSE AS A MECHANICAL BEARING MATERIAL. H. W. Rowell. Chem. and Ind. *57*, 1052–3 (Nov. 5, 1938). An abstract of an informal talk on the use of synthetic resinoid-bonded cellulose bearings in industry, reducing power consumption by as much as 50% and obtaining longer bearing life.

RUBBER PLASTICS. H. Barron. British Plastics *10*, 377–9 (Dec. 1938). First of a series of articles dealing with the properties and applications of rubber plastics, including chlorinated rubber, rubber hydrochloride, oxidized rubber, isomeric forms of rubber, miscellaneous chemical derivatives, and commercial plastic rubber mixes.

PLASTICS IN PHOTOGRAPHY. D. McMaster. Plastics *2*, 363 (Nov. 1938). The uses discussed include the manufacture of film bases, use of molded lenses and camera bodies, and the preparation of corrosion-resistant equipment for production and developing work from acrylic and vinyl resins.

Coatings

HOW SHALL I FINISH? G. Klinkenstein. American Mach. *82*, 1010–12 (Nov. 16, 1938). The advantages and limitations of various finishing processes, such as spraying, dipping, gasket coating, tumbling, centrifuging, roller coating, and brushing, are cited.

SURVEY OF RESEARCH PROBLEMS IN PAINT AND VARNISH. Paint and Varnish Production Mgr. *18*, 403–12 (Dec. 1938). A series of 22 problems of vital interest to the paint industry together with suggestions as to possible experimental procedure is outlined by a technical committee of members of the industry. A bibliography of books and magazines on protective coatings is included in the report. The survey is intended to promote closer cooperation between the industry and university research laboratories.

PHENOL-MODIFIED INDENE-CUMARONE RESINS. J. Rivkin and W. E. Sheehan. Ind. Eng. Chem. *30*, 1228–32 (Nov. 1938). Improvement in solubility and compatibility properties are attained by the introduction of the phenolic groups, the resulting resins being useful in the formulation of cellulose nitrate lacquers and tung oil varnishes.

Testing

PLASTOMETRY OF SYNTHETIC RESINS. R. Houwink and P. N. Heinze. Ind. Eng. Chem., Analytical Ed. *10*, 680–3 (Dec. 15, 1938). Same as Kunststoffe *28*, 283–7 (Nov. 1938). See abstract in Jan. MODERN PLASTICS, page 52.

An OPEN LETTER to Plastic Molders Everywhere ★

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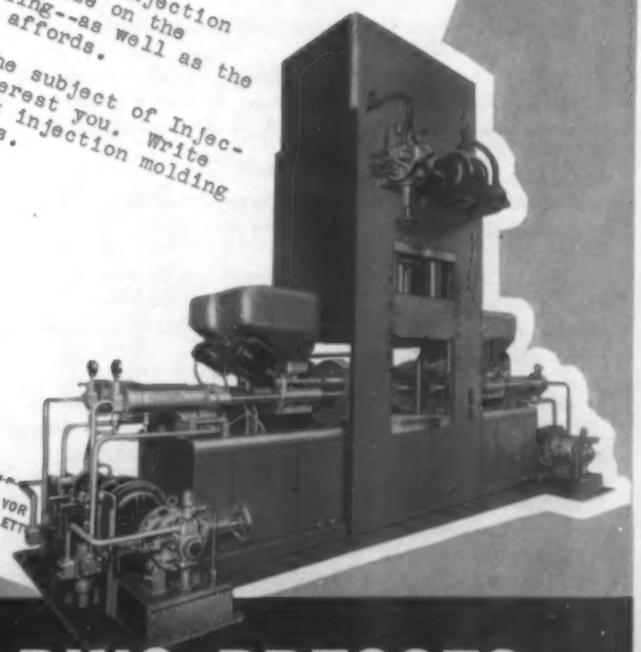

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INJECTION MOLDING PRESSES

U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

ACETATE FOIL. H. E. Martin (to Celanese Corp. of America). U. S. 2,138,184, Nov. 29. Cellulose acetate for making foils is purified by treatment with metal wool so that it will give a haze-free foil.

GASOLINEPROOF RUBBER. Emil Ott (to Hercules Rubber Co.). U. S. 2,138,192, Nov. 29. Blending a chloroprene polymer with gasoline-insoluble chlorinated paraffin wax to make a product which is highly resistant to gasoline.

VARNISH. P. Schnorf (to Hercules Powder Co.). U. S. 2,138,211, Nov. 29. A protective coating composition containing a polymerized rosin ester and a solvent.

MILLINERY STRAWS. J. E. Brandenberger (to E. I. du Pont de Nemours and Co.). U. S. 2,138,568, Nov. 29. Thin, flexible tubing for making hats is prepared from a transparent nonfibrous foil by curling strips longitudinally, with edges overlapped but not sealed.

MOISTUREPROOF FOIL. A. Hershberger (to E. I. du Pont de Nemours and Co.). U. S. 2,138,578, Nov. 29. Method and apparatus for applying a moistureproofing coating to transparent foils.

ARTIFICIAL SPONGE. P. Saffert (to Winthrop Chemical Co.). U. S. 2,138,712, Nov. 29. Sponge made from cellulose hydrate is supported by a cellulosic backing.

ELASTIC ARTICLES. H. Vohrer (to Techno Chemie Kommanditgesellschaft Kessler & Co., and to Dr. Schnabel & Co. Kommanditgesellschaft). U. S. 2,138,751, Nov. 29. An aqueous paste of water-insoluble polyvinyl alcohol and plasticizers is pressed into a desired shape and heated at 80–100°C. to form an elastic product.

DENTURES. J. H. Schmidt (to Bakelite Corp.). U. S. 2,138,795, Nov. 29. Effecting a phenol-formaldehyde condensation in presence of sodium carbonate to make a resin suitable for use in dentures.

ABRASIVE. N. P. Robie (to Carborundum Co.). U. S. 2,138,882, Dec. 6. Use of woven glass fabric instead of paper or cloth as backing for an abrasive article having a heat-hardened resin binder.

TRANSPARENT SHEETING. H. B. Smith and D. R. Swan (to Eastman Kodak Co.). U. S. 2,138,889, Dec. 6. Rubbery transparent sheeting is made of a polyvinyl acetal resin, elasticized with diphenyl ether and a dialkyl phthalate.

PLASTICIZERS. Wm. H. Moss (to Celanese Corp. of America). U. S. 2,138,934, Dec. 6. Use of acyloxyalkylsulphonamides as plasticizers for cellulose esters or ethers or for vinyl resins.

BLENDED LACQUER. G. R. Ensminger (to E. I. du Pont de Nemours and Co.). U. S. 2,139,008, Dec. 6. A pigmented nitrocellulose lacquer containing a polymerized ester, amide or other derivative of acrylic acid and adapted to resist chalking or bronzing.

PRINTING PLATES. S. C. Wilson (to Econo Products, Inc.). U. S. 2,139,054, Dec. 6. In making rubber plates for relief printing a matrix is first made from a heat-hardenable synthetic resin.

VARNISH RESIN. H. Hönel (to Helmuth Reichhold, Reichhold Chemicals). U. S. 2,139,081, Dec. 6. Making a varnish resin by strongly alkaline condensation of a mixture of substituted phenols with excess formaldehyde.

CHLORINATED RUBBER PAINT. J. H. Kelly, Jr. (to Monsanto Chemical Co.). U. S. 2,139,368, Dec. 6. In paints made with chlorinated or oxidized rubber a stabilizing plasticizer is used, e. g., butylphthalylbutyl glycolate or methylphthalylethyl glycolate.

PLASTICIZERS. L. P. Kyrides (to Monsanto Chemical Co.). U. S. 2,139,369, Dec. 6. Plasticizing cellulose esters or ethers or alkyd, phenolic or vinyl resins with esters or ethers of xylyleneglucols.

HYDROGENATED RESIN. Wm. H. Carmody (to Neville Co.). U. S. 2,139,722, Dec. 13. Freeing a cumaron-indene resin from catalyst poisons, hydrogenating in presence of a catalyst and separating the product from the catalyst.

ELECTRODE SYSTEM. J. H. de Boer and W. C. van Geel (to V. Philips Gloeilampenfabrieken). U. S. 2,139,731, Dec. 13. An asymmetric electrode system with metal electrodes and an insulating layer of polystyrene resin containing powdered mica.

GLOSS METAL FINISH. D. G. Higgins (to E. I. du Pont de Nemours and Co.). U. S. 2,139,824, Dec. 13. Coating a surface with a resin varnish, dusting with metal powder when still not quite dry, and finishing with one coat of a resin varnish and one of a transparent colored lacquer.

ACRYLONITRILE RESIN. H. Fikentscher and C. Heuck (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,140,048, Dec. 13. Emulsion polymerization of acrylonitrile in a nonsolvent liquid.

PHOTOGRAPHIC FILM. M. Marasco (to Du Pont Film Mfg. Corp.). U. S. 2,140,089, Dec. 13. A moistureproof photographic film base is made of a cellulose derivative foil, faced on both sides with a layer of alkyl methacrylate resin.

TEMPORARY PROTECTIVE LACQUER. M. D. Helfrick (to Western Electric Co.). U. S. 2,140,131, Dec. 13. Metal to be formed into a cup-shaped article is electroplated, coated with a cellulose derivative lacquer to protect and lubricate the plating, and formed to the desired shape; the lacquer film is then removed.

TUBING. J. B. Tegarty (to Thermo-Plastics, Inc.). U. S. 2,140,213, Dec. 13. Forming a narrow flat strip of thermoplastic material into tubing by rolling the strip so that its edges meet, wetting the edges with a solvent and pressing to seal the edges together.

STENCIL SHEET. C. V. Canning (to Sweets Laboratories, Inc.). U. S. 2,140,506, Dec. 20. Coating stencil sheets with a blend of cumaron resin and raw rubber, softened with an oil.

VINYL RESIN VARNISH. A. K. Doolittle (to Union Carbide and Carbon Corp.). U. S. 2,140,518, Dec. 20. A baking varnish contains a vinyl chloride-vinyl acetate interpolymer, heat-stabilized with metallic aluminum, cadmium or magnesium, or with a sulphide or sulphite of one of these or of another metal.

MOLDING COMPOSITIONS. L. Smidth (to Luco Products Corp.); L. Smidth, U. S. 2,140,560; 2,140,561, Dec. 20. Making a primary urea-formaldehyde condensation product in presence of a filler, removing water and completing the condensation at a temperature at which liberated water distils off, to obtain a dry fusible molding composition; and a similar process, without filler, in which the final reaction is effected in presence of an acid.

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Foreign Plastics Patents

Application dates are given for patents of European countries, but for Canada the issue date is given

PACKING. La Fibre Diamond. French P. 825,658, Nov. 27, 1936. Heat-resisting packing, sheet material and the like is made by impregnating a cellulosic web with urea-formaldehyde resin and cementing to it a backing of aluminum foil.

POLYMERIZATION. Societe Industrielle des Telephones. French P. 827,841, Jan. 15, 1937. A polymerizable substance is extruded through a slot or an annular orifice as a band or tube, into a mold in which it is heated to polymerization temperature, while being continuously withdrawn from the mold.

SUPERPOLYMER FIBERS. E. I. du Pont de Nemours and Co. French P. 827,798, Oct. 12, 1937. Synthetic fibers, made from superpolyamides, are delustered with white oxide, sulfate or carbonate pigments and may also be colored, e. g., with carbon black, ultramarine, lead chromate or the like. Superpolymer foils may be similarly treated.

WATERPROOFING FABRICS. Wm. J. Carter (to National Processes, Ltd.). Australian P. 103,296, Dec. 22, 1936. Waterproofing and rotproofing cotton, flax, jute, silk or rayon goods with cellulose ester emulsions or pastes or with emulsions of synthetic resins, e. g., of the vinyl polymer or cumaron types.

POLYVINYL CHLORIDE. H. Fikentscher and W. Franke (to I. G. Farbenindustrie Aktiengesellschaft). Can. P. 377,061, Oct. 11, 1938. Interpolymerizing vinyl chloride with 0.5 to 3% of methyl acrylate, methacrylamide or the like.

HAND GRIP. F. W. Bluemel (to Bluemel Bros., Ltd.). British P. 485,659, Nov. 25, 1936. Hand grips, bicycle pump handles and the like are molded from plastics, e. g., cellulose derivatives, with space for a metal name plate which may be rivered in place.

BATTERY BOXES. Lancaster Processes, Inc. British P. 485,679 and 485,680, Dec. 15, 1936. A cheap plastic from which battery boxes, noncorroding pipe, roofing shingles and other objects can be molded comprises a water-in-asphalt emulsion, with lignin (from wood chips) as filler. Elimination of the water sets the plastic.

MOLDING HORN. M. Kraus. British P. 486,146, Feb. 11, 1937. Horn powder, made from horn or hoofs, is mixed with urea-formaldehyde resin solutions, dried, ground and hardened by mild heat (not above 70°C.). Molding may then be effected at 130–150°C.

INJECTION MOLDING. F. Braun Aktiengesellschaft, British P. 486,539 and 486,540, Dec. 4, 1936. Loose thermoplastics, e. g., vinyl resins or cellulose acetate, can be successfully molded by the injection method in a device which preheats the powder before the extrusion pressure is applied. Electrical heat, supplied from coils embedded in parallel plates, is preferred.

PULP GRINDERS. Kurt Schwalbe (to Kübler and Niethammer). German P. 662,638, June 15, 1934. Stones for grinding mechanical wood pulp are made by filling a wood mold with a stiff paste of sand in a liquid phenol-formaldehyde or urea-formaldehyde resin and a hardening agent which will harden the resin in 2–3 days without applying heat.

PAPER SIZE. G. Blaser and H. Fikentscher (to I. G. Farbenindustrie Aktiengesellschaft). German P. 663,445, Sept. 27, 1936. Sizing paper with a mixed synthetic and natural resin size, using water-soluble polymers of acrylamide or of methacrylamide in a rosin size. A substantial saving in rosin is effected.

METALLIZED MICA. Steatit-Magnesia Aktiengesellschaft. British P. 487,839, Dec. 23, 1936. Mica for use in condensers is coated with a conducting metal film by brushing or spraying with a hardenable resin solution containing a metal, e. g., silver, which is not easily oxidized.

AEROFOIL. A. G. Coats and R. Hafner. British P. 486,883, Dec. 11, 1936. A blade for rotary wing airplanes has a steel spar and a molded synthetic resin aerofoil shaped fairing with such a low modulus of elasticity that the fairing is not called upon to relieve the spar of any of its load.

AMINOTRIAZINE RESINS. Gesellschaft für Chemische Industrie in Basel. French P. 827,014, Sept. 22, 1937. Resins which can be used in adhesives, varnishes and plastics are made by condensing formaldehyde with an aminotriazine such as 2,4,6-aminohydroxyphenyl-1,3,5-triazine in presence of cetyl alcohol, dodecyl alcohol, glycerol or the like.

NAPHTHENIC ACID RESINS. Standard Oil Development Co. French P. 827,203, Sept. 28, 1937. Modifying alkyd resins, or interpolymers derived from maleic anhydride and a diolefin such as butadiene or isoprene, with naphthenic acids recovered from petroleum. The products are useful in varnishes and as plastics.

CIGARET PAPER. R. T. Ubben (to Canadian Industries, Ltd.). Can. P. 376,701, Sept. 27, 1938. Impregnating cigaret papers with a water-insoluble vinyl resin.

EMULSION LACQUER. H. A. Auden and H. P. Staudinger (to Distillers Co., Ltd.). Can. P. 376,736, Sept. 27, 1938. A cellulose ester lacquer in a vehicle of the water-in-oil emulsion type formed by emulsifying water in a solvent which evaporates more slowly than does water.

PRINTING PLATE. Clarence E. Boutwell. Can. P. 376,787, Sept. 27, 1938. A plastic cellulose derivative printing plate containing a carbonate, sulphate or oxide to toughen the plastic and improve its ink retention.

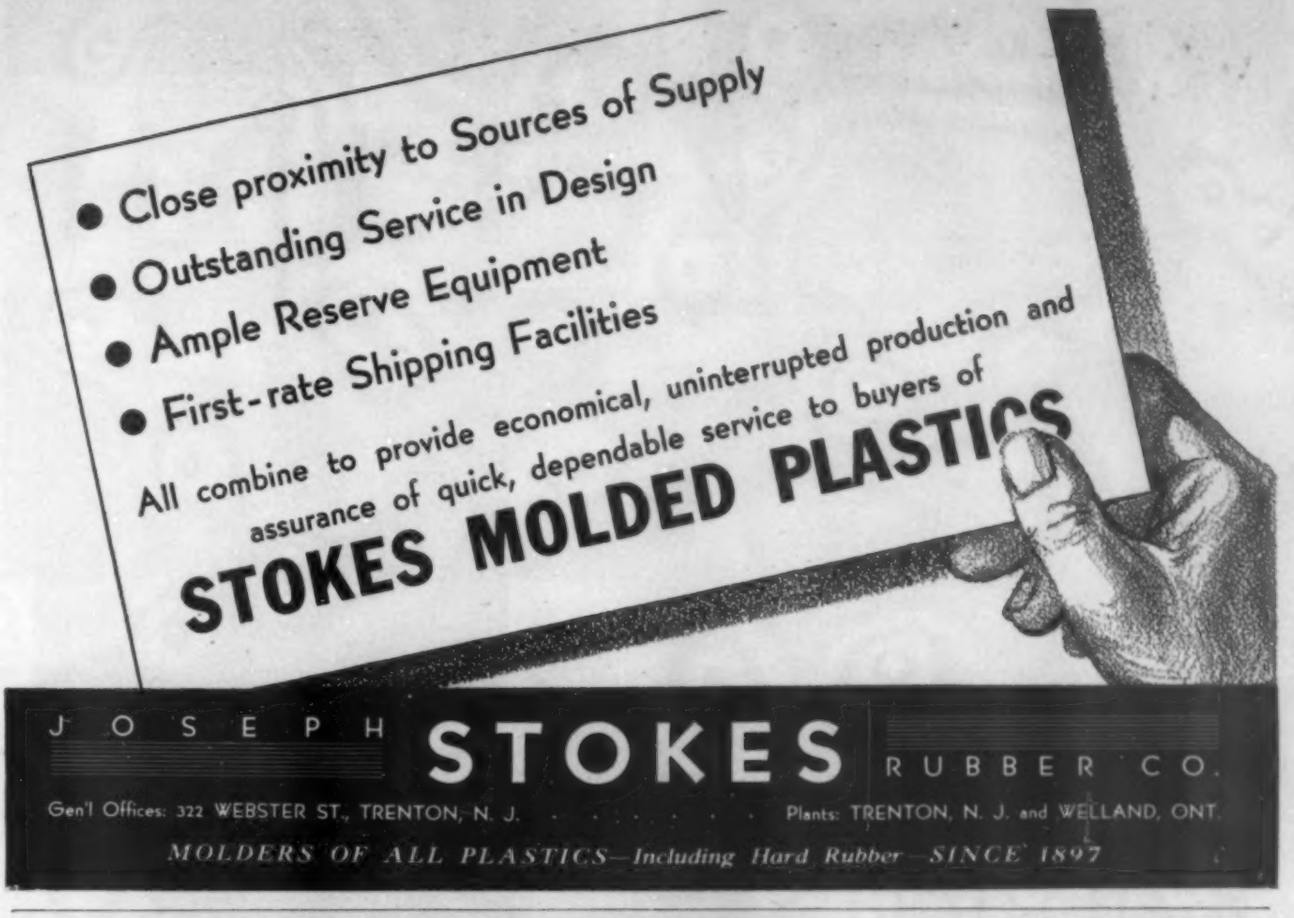
MOLDING COMPOSITION. Dr. Kurt Albert G. m. b. H. Chemische Fabriken. German P. 663,622, April 8, 1935. Rubberized fibers, e. g., from tire fabric scrap, are used as filler in phenolic resins to make molded articles with great mechanical strength.

POLYACRYLATES. I. G. Farbenindustrie Aktiengesellschaft. German P. 663,469, June 5, 1930. Emulsion polymerization of acrylic acid or its homologs or derivatives thereof in admixture with a relatively small proportion of nonpolymerizing substances.

SAFETY GLASS. Societe des Usines Chimiques Rhone-Poulenc. German P. 663,577, Nov. 5, 1931. The plastic interlayer of a safety glass assembly is exposed to a vacuum for a time before interposing it between the glass plates.

SIZE FOR PAPER. I. G. Farbenindustrie Aktiengesellschaft. German P. 663,445, Sept. 25, 1936. Sizing paper with water-soluble resins made by polymerizing amides of unsaturated carboxylic acids.

LAMINATED SHEETS. Jaroslaw's Erste Glimmerwarenfabrik. German P. 663,702, Aug. 26, 1934. Sheet material made by joining webs of paper to layers of synthetic resin are prepared so that none of the binder penetrates to the outer surface of the top sheet.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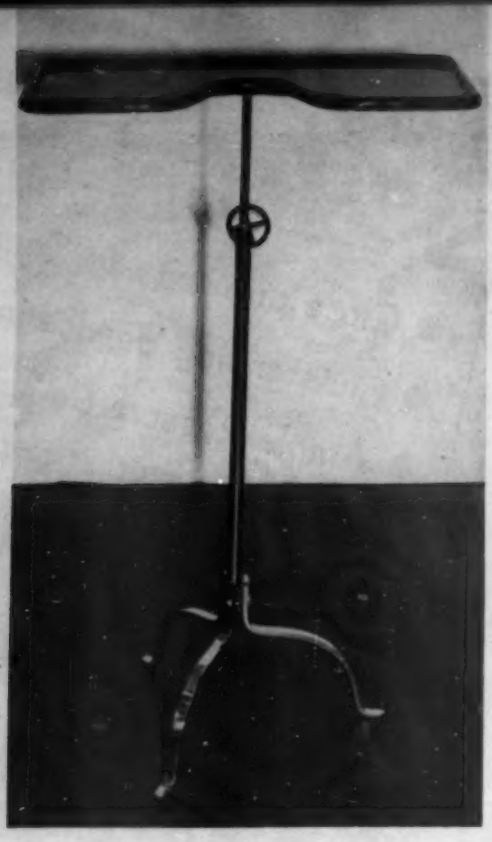


This Bakelite tray, molded by Auburn Button Works, Inc., was designed by Kathryn M. Conley, owner and operator of a beauty salon at Saratoga Springs, New York

THE AMERICAN GIRL

In her search for beauty, the American Girl demands modern equipment, comfort, and freedom from fatigue

FROM SIXTEEN TO SIXTY—EVEN BEYOND, THE American Girl contributes her share to the reported five hundred million dollars spent annually for cosmetics to use at home and in the nation's sixty-five thousand salons, in search of beauty. Within the memory of our present generation, beauty has become big business and the woman who doesn't use cosmetics for the improvement of her personal appearance is in the minority.

The cosmetics industry is largely a woman's business. Women prominent in aviation and in the movies have recently begun to sponsor beauty aids which they have worked out and found worthy of sharing their names.

It is not surprising, therefore, that the first all molded plastic tray, created exclusively for the comfort of beauty patrons and for the convenience of operators, was designed by a woman, Kathryn M. Conley, who owns and operates a beauty salon at Saratoga Springs, New York.

The tray is 24 in. long, 12 1/4 in. wide, and 5/8 in. deep. The edge is rolled to a thickness of 5/32 in. There is a boss on the under side with a threaded brass insert molded in place by which it is attached to a chrome plated steel pedestal. Four supporting ribs radiate from the boss to give it strength. Adjustable to a convenient height, the tray is shaped to serve as a comfortable rest for the head and neck during the permanent wave and a convenient working surface for the operator.

A permanent wave requires the hair to be wound on curlers, pads saturated with chemicals are used, heating elements are clamped over the curls, then heat is applied. Considerable time is required to *set* the wave and the seven pounds or more of weight which the head must support during this period causes discomfort and fatigue.

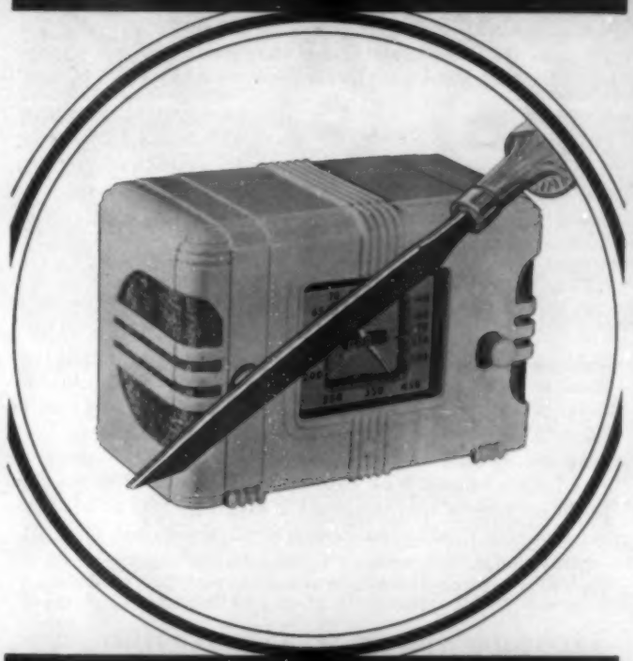
It was to relieve this condition that Miss Conley set out to design the headrest and tray you see pictured here. She chose plastics for logical reasons. They could be molded to the exact shape she required. Their finish would be permanent and unaffected by the heat and chemicals with which they are often in contact.

Perhaps of even greater importance is the fact that they provide a working surface of perfect insulation against electrical contact with the heating elements. The tray is safe and is never too hot or too cold to the touch.

She met the obstacle of cost with the same feminine logic. She knew that a tray of this sort would have a universal demand. She was well aware that other beauticians were faced with the same difficulties she herself had met in providing comfort during permanent waves.

So she gambled the cost of the mold, placed an initial order that would give her a reasonable price and offered them to the trade. This new tray is equally at home in elaborately decorated salons and in small shops because it is businesslike and sanitary in appearance.

HALF THE BATTLE



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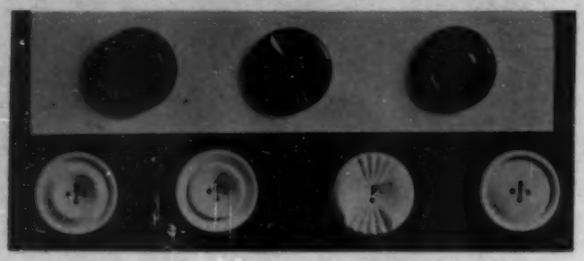
NEWS



A TRANSPARENT THERMOPLASTIC MATERIAL DEVELOPED from potato starch is reported from the Netherlands through the Bureau of Foreign and Domestic Commerce. The new material, known as Anras-glass in transparent form and as Amylite when opaque, is considerably lighter than glass. In the transparent form, it is said to have superior optical properties with ultra-violet light. The new material has sufficient strength to be used in combs, hot-houses, leaded glass windows, displays and boxes. It may be readily bored, sawn, ground or shaped, and may be colored with a wide range of dyes and pigments. In the present stage of development, however, it retains a sensitivity to immersion in water.

The Anras-combinatie, a research organization with headquarters at Veendam, is responsible for the development. Since the new plastic is relatively cheap, wide commercial acceptance is expected.

PRESIDENT C. S. MUNSON ANNOUNCES THAT SINCE JAN. 1, 1939, all manufacturing and selling activities of the U. S. Industrial Alcohol organization, with the exception of resins, are being conducted by U. S. Industrial Chemicals, Inc., a wholly owned subsidiary, formerly known as U. S. Industrial Alcohol Sales Co., Inc. This change of name designates more accurately the present nature of the U. S. I. organization's business and reflects also its greatly widened scope in the chemical field. The same organization and plant facilities will continue to serve U. S. I.'s customers as before. U. S. Industrial Chemicals, Inc., is beginning the manufacture of cellulose acetate at a new plant constructed for this purpose at Baltimore, Md.

ANNOUNCEMENT IS MADE THAT NILS FLORMAN, JR., HAS opened an office at 629 West 50th Street, New York, N. Y., and is currently representing the Adamson Machine Company and the R. H. Freitag Company, serving the plastics trade in the East on both machinery and molds.

DECORATIVE MICARTA, LAMINATED PLASTIC MANUFACtured by the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., is now available in 22 new standard colors. All the new colors are derived directly from primary colors and have been so developed that any combination may be used side by side without disagreeable contrast. The new standard colors include four blues, four greens, four yellows, three reds, four browns, grey, black and white.

APPOINTMENT OF C. F. REEVES AS MANAGER OF THE NEW York sales branch of Monsanto Chemical Company's plastics division was announced recently. All sales activities in the New York area for the Monsanto group of plastics will be under his supervision. Mr. Reeves will make his headquarters in the Monsanto Eastern general offices in the RCA building, New York, N. Y.

Appointment of F. A. Abbiati as sales manager of all Monsanto sheet plastics also was announced.

S. A. Bell has been promoted from within the sales organization to assistant sales manager of sheets, rods and tubes under Mr. Abbiati.

ALBERT R. BOURGES SERVICE, 175 FIFTH AVE., NEW YORK, N. Y., has recently introduced a non-corrosive ink for marking of plastic surfaces. The new ink is said to write smoothly on smooth, glossy finishes without blotting or smearing. When dry it provides a marking that will remain legible under considerable wear. Special pens for use with the ink are available, but it may also be applied with brushes and standard drawing instruments.

THE INDUSTRIAL DIVISION OF THE S. S. WHITE DENTAL MFG. Co., 10 E. 40th Street, New York, N. Y., announces a new role as custom molders with a new plastics department, specializing in thermoplastics injection molding in acetate or all similar thermo-plastic materials. This organization has had many years experience in designing and molding plastic parts for their own products.

THE RÖHM & HAAS COMPANY, INC., OF PHILADELPHIA, PA., manufacturers of plastics, resins and other chemical products, announces that they have retained Mr. Gilbert Rohde, Industrial Designer, as consultant in the development of their Plexiglas and Crystalite products.

SEVERAL IMPORTANT CHANGES IN PERSONNEL ARE ANnounced by the Plaskon Company, Toledo, O. Richard B. Harrison, Vice-President, is placed in charge of the Toledo sales office and Whiting N. Shepard, formerly in charge of the Toledo sales office, has now been placed at the head of sales and service in the Chicago area, assisted by G. T. Walker, Jr. Carleton Ellis, Jr., who has until now been in charge of the Chicago office, will henceforth be in Toledo.

An office of the Plaskon Company has been opened in Rochester at 1045 Lincoln-Alliance Bank Building and C. Burton Wing has been placed in charge of sales and service in that territory. A. E. Egerter has moved to Toledo where he is now in the sales and advertising department. H. W. DeVore maintains his headquarters in Toledo, but will be in supervision of sales and service for Ohio and Michigan.

COLLAPSIBLE TUBES OF PLASTIC-IMPREGNATED FABRIC, replacing tin and other metals are coming into use in Germany. Stimulated by a recent decree prohibiting the use of imported metals in tube making, the material, known as Celloglas, is reported to be tasteless, waterproof and odorless. Although tariff restrictions make direct import to this country unlikely, negotiations are under way to license its production here.

ASSOCIATED ATTLEBORO MANUFACTURERS, INC., ATTLEboro, Mass., have announced the appointment of Mr. A. O. Burgess, Room 1304, 303 5th Ave., New York, N. Y., as their representative.

"MODERN PLASTICS PREFERRED," THE MOTION PICTURE recently produced by Modern Plastics Magazine is finding wide demand throughout the country. A number of prints are in circulation. Bookings in the near future are: February 2, Monowatt Electric Co., Providence, R. I.; February 2–3, Chicago Molded Products Corp., Chicago, Ill.; February 3, Chicago Molded Products Corp., Scranton, Pa.; February 6, Advertising Club of Springfield, Springfield, Mass.; February 7, Rotary Club, Valley Molding Co., Boonton, N. J.; February 8–9, County Industrial Club, New Products Corporation, Boonton Harbor, Mich.; February 8, Reed-Prentice Corp., Worcester, Mass.

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➡ **FOR SALE—2 #10 REED-PRENTICE 2 oz. capacity automatic Plastic Injection Molding Machines, motor drive, good condition; 2-ISOMA Plastic Injection Molding Machines, good condition; 1 Eckert & Ziegler Model III Automatic Injection Molding Machine, good condition. Reply L. H. Mesker, Engr., % Hollenden Hotel, Cleveland, Ohio.**

•

➡ **WANTED IMMEDIATELY: Large Molding Presses, Multiple Ram Presses, Injection Presses, Hydraulic Pumps, Hydro-Pneumatic Accumulators, Preform Machines, Pebble Mills, Mixers, Sifters, etc. WILL PAY CASH. We carry large stocks of Plastics and Hydraulic Equipment. Send us your inquires. Reply Box 220, Modern Plastics.**

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➡ **PLASTIC WRITING INK (Intense Black) and BOURGES FOUNTAIN PENS are sold subject to *complete refund* after one week's trial. INK $5 Pt., $9.25 Qt., Samples 35c. PENS $5 each (#1 fine point, #2 stub and #3 broad), $14 for set of 3. Prices less 5% postpaid on C.O.D. Albert R. Bourges Service, 175—5th Ave., New York, N. Y.**

•

➡ **A reputable, well rated corporation in a small Pennsylvania town, who are installing a Custom Plastics Division, is interested in hearing from a reliable man, thoroughly experienced in the technique of pressure and injection molding of plastics. This man must have a wide knowledge of all the ramifications of the plastic industry. He must be willing to cast his lot and grow with the business. Give age, experience and record for past 15 years. Send photograph, state whether married or single, also salary desired. Give telephone number. All communications treated as confidential. Reply Box 259, Modern Plastics.**

➡ **STATE CHEMIST would like to advise on COLD MOLDING. Does not want permanent position in this field. Moderate charge. Reply Box 260, Modern Plastics.**

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➡ **JEWELRY TRADE REPRESENTATIVE to manufacturers of jewelry, rings, dress ornaments, bag frames, compacts and cigarette cases in Providence and area; has been in contact with this trade for past 14 years selling imported glass stones, jewels and novelties; is seeking plastic novelty items and packaging boxes suitable for these manufacturers. Reply Box 261, Modern Plastics.**

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➡ **MOLDING PRESS FOR SALE: 400 Ton Inverted Ram Molding Press, 24″ dia. ram, 22″ stroke, 47″ total daylight, 30x30″ between the rods, with a pullback ram. Reply Box 262, Modern Plastics.**

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➡ **INDUSTRIAL CHEMIST about 35 years. Must have practical plant supervisory experience in cellulose derivatives line, also capable to combine technical laboratory research with plant activities. This position requires a man who has had and can assume executive responsibilities. Location New York State. Is permanent for the right man. Answers must cover fully education, previous employers and positions held, age, minimum salary expected. All replies treated confidential. Reply Box 263, Modern Plastics.**

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➡ **PLASTICS PRODUCTION and DEVELOPMENT ENGINEER desires connection with progressive firm, unusual; wide and varied experience in all departments of the molding industry; Plant production, material, tool and die design, sales. Young, American. Location anywhere. Well-known in trade. Reply Box 264, Modern Plastics.**

Publications

Write for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent postpaid at the publishers' advertised prices.

Purpose in Design

By A. Defries

Published by Methuen & Co. Ltd., London

Price 21/Net Foreign **238 pages**

In a country like ours whose executives think entirely in terms of mass production and cost per unit, it is refreshing to read a review of international opinion and practice on the subject of design. Based upon the International Exhibition of Arts and Techniques in Modern Life held in Paris, this book is intended for collectors, manufacturers, retailers, teachers, craftsmen and artists, and for the public whom these groups serve.

If this nation is to be sacrificed to the Machine-god, our everyday commodities will continue to sacrifice appearance to engineering and production convenience with a growing apathy of public enthusiasm to buy. On the other hand, those manufacturers who recognize the fact that ours is a land of liberty (at the present writing) and that people buy what pleases them most, will profit greatly by a study of design as applied to their products. To them we recommend this book as profitable reading. E.F.L.

THE SECOND REVISED EDITION OF "A READY REFERENCE for Plastics" has been issued by the Boonton Molding Co., Boonton, N.J. The new booklet covers the same type information on materials, methods of fabrication and typical applications as previous editions, but all data has been brought up to date. Several new tables are also included.

HAMMOND MACHINERY BUILDERS, KALAMAZOO, MICH., have published a booklet describing their high speed automatic buffing and polishing machines. The booklet illustrates the various sizes and models available and gives specifications and directions for their use.

"DOW PLASTIC MATERIALS AND PLASTICIZERS" IS A 26-PAGE illustrated booklet issued by the Dow Chemical Co., Midland, Mich. The materials manufactured by the company for use in the plastics industry are described in detail. Physical, electrical and chemical properties are listed and applications given. Typical uses and methods of fabrication are also included. The booklet is spiral bound in such a manner that additional pages may be added when issued, making it a permanent source of data.

THE HACK MACHINE CO., 440 NORTH OAKLEY BOULEVARD, Chicago, Ill., has published a booklet describing their Multi-Versal machine tool. The equipment combines in one unit the functions usually performed by a number of separate machines. Due to various novel construction principles, shifting from one type of operation to another is said to be accomplished with little loss of time.

THE ADVANTAGES OF A MOORE JIG BORER ARE FULLY EXplained and illustrated in a pamphlet issued by the distributors of these machines, Marburg Bros., 90 West Street, New York, N. Y. The accuracy of boring with there machines is claimed to give better interchangesbility, quicker assembly and lower cost of shop operations.

BALL & JEWELL, 22-28 FRANKLIN ST., BROOKLYN, N. Y., have published a catalog describing and illustrating their line of 11 models of rotary cutters, in capacities ranging from 25 lbs. to 2500 lbs. per hour, which are being offered the plastics industry for the reclaiming of scrap, sprues and rejects. With this equipment it is said that substantial savings in material costs can be made, especially in injection molding operations.

LATEST AID TO EDUCATION

(*Continued from page 38*) arithmetic, from high pressure boilers to Little Red Riding Hood, the book serves as a novel way of presenting an idea or a story. In showing the anatomy of a man, for instance, one leaf shows the skeleton, another the nervous system, still another the respiratory mechanism and so on. When the leaves are all together, there is a complete picture of the human anatomy. Turning the page backward dissects it step by step, so that each element may be studied closely while its relation to the whole is clearly indicated.

The basic idea of this new educational aid is also applied to screen projection. Sheets of cellulose acetate, prepared in the same way as those in the book are placed in a projection machine and their image thrown onto a screen. These machines have long been used in lectures and demonstrations, but with this development, the image may be disassembled and rearranged.

Besides being a means of visual education, the book has potentialities in advertising and sales demonstrations. Complicated machines, often difficult to demonstrate in such a way that intricate functions are explained or hidden features brought out, are simplified in dramatic fashion. Each part is highlighted and the best features are brought to one's attention. Salesmen can easily carry one of these books in an ordinary briefcase; no machinery or apparatus is needed to use them.

Thus far, the books are being made by painting sheets of plastic by hand. Considerable attention is being paid to artistic effect and many colorful books have been turned out. With plastics, these can be faithfully reproduced in mass production quantities, by printing or lithographing in full, rich colors.

COLOR

(*Continued from page 40*) Therefore, we have only one possible alternative, the use of complementary colors.

The complementary colors can be chosen in Chroma about equally, whether they be dark or light, so that while they contrast in Hue, they do not contrast in Value. That is, a dark yellow and a dark blue might not be as exciting as a light yellow and a dark blue though the same purity of color is present throughout.

Assuming that our color scheme is established, let us apply color to our everyday life and home. Every room has some function which suggests given ideas and associations. Color in the library suggests study and quiet; in the dining room, good cheer and hospitality; in the kitchen, cleanliness; and in the bedroom, repose.

We may ask if a color is capable of responding to these various ideas. We have seen that colors may be warm or cold, advancing or receding, but they may be so chosen as to suggest comfort, cleanliness, and elegance. Of course, it must be borne in mind that any suggestions which follow are personal ones, so the true approach to the question is one of experiment, with the leading principle as the restraints upon imagination.

Phenoform Colors

A wide range of colors for plastic compounds — especially selected and prepared to meet the most exacting requirements in molding. For particulars apply to

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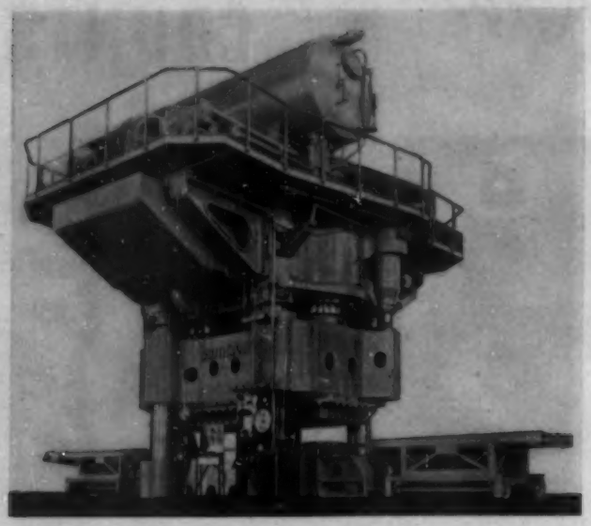
In plastic molding, it's in the making of the mold that superior craftsmanship and experience prove their value. Here the accuracy and precision which govern the quality of your job reflect the skill of our craftsmen. At Auburn, precise accuracy starts with the die-making and continues clear through to the series of exacting inspections which have such an important bearing on your satisfaction with the finished job.

It's a quality story all the way, dependent entirely upon craftsmanship *plus* experience. It's quality with economy, too, whether it's a simple ashtray or a complex electrical or mechanical part with close tolerances. Let an Auburn Engineer tell you the whole story.

Established 1876

MOLDED PLASTICS DIVISION OF
AUBURN BUTTON WORKS, Inc.
AUBURN, N. Y.

Equipment



A MASSIVE-5500 TON CAPACITY SOUTHWARK HYDRAULIC Press is one of three designed and built by the Southwark Division of Baldwin-Southwark Corporation in their Eddystone, Pa., plant, especially for forming duralumin aircraft parts. The press, of the rapid-acting type, is completely automatic, having control of pressure, operating speed and length of stroke. It is equipped for semi-automatic or manual operations as well.

Huge, single steel castings, the press platens weigh approximately 160,000 pounds each. A total of 400 H.P. of electric motors are required to operate the pumps located on top of the 30 ft. long, 23 ft. wide platform which supports the complete power unit, control gear and operating valves. The press stands 33 ft. high and weighs approximately 960,000 lb. The complete shipment of three presses comprised a total of 42 carloads.

THE READ MACHINERY CO., INC., ANNOUNCES A NEW VACuum mixer for processing a variety of materials including plastic compounds. Stainless steel, polished to a mirror-like surface is used in the bowl, cover, arms and shafts.

ACME ELECTRIC HEATING CO. HAS ANNOUNCED A NEW automatic glue and compound electric kettle. The equipment is of the water-heated type and is provided with a thermostat to control the temperature at constant level. Since the kettles are constructed of virgin copper throughout, they are said to have excellent durability.

CONTINENTAL MACHINE SPECIALTIES ANNOUNCE AN IMproved design for their Speedmaster variable speed pulleys. These new variable speed pulleys are molded of solid high impact strength Bakelite, accurately trued and balanced before final assembly. An improved pressure lubricated bronze sleeve allows the splined center sheave member to operate freely, regardless of load or speed.

The new construction is available in two sizes, a $3^1/_2$ in. diameter size for drives up to $^1/_2$ HP capacity and a $6^1/_2$ in. diameter size for drives up to 3 HP capacity. The pulley is flexible in its adaptability to both "straight line" and "angular" drives. Interposed between motor and driven unit, the position of the pulley can be changed to vary the center distances of the Speedmaster pulley in relation to the drive and driven sheaves. The belts thus assume smaller or larger operating pitch diameters through the action of the variable pulley faces. Control of speed is made through a quick action lever, or a handwheel allowing control of speed within 1 RPM.

A NEW "FIRST"

(*Continued from page 25*) could be turned out in cast resin for much less money than in glass but it took a lot of demonstrating to convince these contractors that phenolic resin was suitable to the work.

He had long dreamed of casting huge statues in rubber molds. Now his dream became a nightmare. He had to find a resin manufacturer with ovens big enough to cure the figures as well as a resin meeting specifications. Ordinary casting resins wouldn't do.

Then it took weeks to make the huge rubber and plaster molds. Built on rolling trucks, about twenty-five hundred pounds of plaster went into each one. Mancuso begins by making an outer mold, using a sculptured model. After padding the inside of the shell with clay to the desired thickness, he makes an inside mold. Since the figures are hollow, the plastic is poured between these two molds at a temperature of 85 deg. C. under the pressure of its own weight. The casting is then cured at a temperature of 85 deg. C. for ten days. When the molds come from the ovens they are taken to Mancuso's studio still sealed. They weigh nearly two tons and are 11 by 12 feet overall.

After the figures are removed from their plaster shells, the rubber mold is peeled off like an undershirt and can be used again. The plaster shell is destroyed as it is removed. Once out of the mold there is little finishing to do, unless a sandblast surface is required. Every mark of the sculptor's tools is faithfully reproduced in the finished work which has a natural gloss.

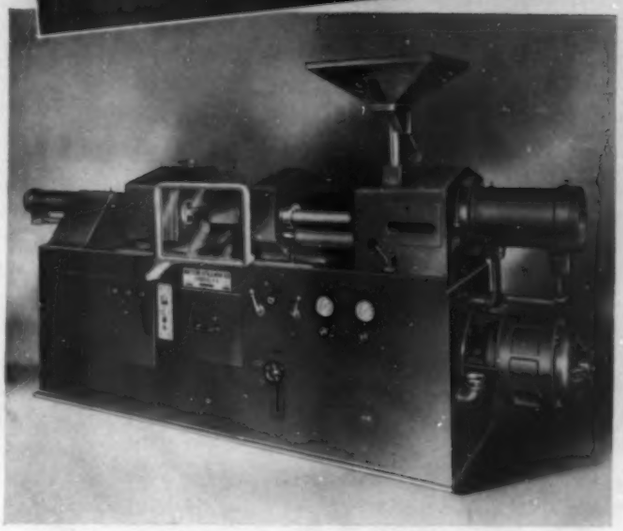
Casting presents its own problems. If cured too long, the resin exhibits curious color changes. Perfect timing and control are essential to each operation if anything like uniformity of color is to be obtained. Variation between different batches of resin must be infinitesimal. Ingredients must be weighed with perfect precision. They must be reacted under identical conditions to be alike. Curing is equally important after the material is cast. The curing time is dependent on the exact weight of the material and is based upon many experiments before the final statue is poured.

The Federal exhibit, according to a *Science Service* release, will be divided into twelve parts, representing the twelve functions of government as they affect the average citizen. In each section, the central figure will be one of these sculptured masses of cast plastic. The 1500-pound figures will be lighted from within.

Two other contractors besides The Diorama Corporation are responsible for producing these huge statues—Victor M. Clark, New York City; and Gardner Displays, Inc., Long Island City—each for four.

With eight of the twelve figures successfully cast (as this is written) Mancuso begins to realize what a crazy job he set out to do. "I didn't see any reason, though," he said, "why the idea couldn't be carried out in the rubber molds I have developed but it really took more courage than brains to do it. Anyway, it worked. And I believe the experiment will point the way to new architectural uses for cast resins, never thought of before."

WASCO . . . INJECTION MOLDING MACHINES



The No. 6 WASCO Automatic Injection Molding Machine has created widespread interest because of design and construction features that assure faster operation — increased production — new operating economies.

For instance, the clamping mechanism, which is of an improved type, affords positive clamping of dies having up to 75 sq. in. projected area.

The maximum opening between die plates is 24", with an adjustment of 0" to 18" on the clamping end. There is no extra charge for this exceptionally large opening.

The bore of the heating cylinder is smooth and of uniform diameter. There is absolutely no place for material to lodge. This is a distinct advantage when changing from one color to another.

These are but a few of the exclusive features of the WASCO Injection Molding Machine.

For further information and detailed specifications write The Watson-Stillman Co., 118 Aldene Road, Roselle, New Jersey.

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GENERAL ANDREW JACKSON
Tackled Big Jobs and Small

His military activities ranged from skirmishes with the Indians on the frontier to battling the British at New Orleans; and in civil life from managing his estate in Tennessee to guiding the destinies of the Nation. His election to the Presidency marked a new epoch in our history.

No molded plastic job too big, none too small for
GENERAL INDUSTRIES

Whatever the size or nature of your molded plastic requirements, you can be sure General Industries Plastics Division can handle it efficiently and to your fullest satisfaction. General Industries equipment is thoroughly modern, including presses for molding pieces of any size and shape. All operations are under one roof. We make our own molds and have a Metal Division for producing metal inserts.

If you want to be assured of high quality, prompt deliveries and favorable costs, make us a source of supply for molded plastic parts.

Let us figure on your next job. Just send us your blue prints and give us an indication of your monthly requirements.

GENERAL INDUSTRIES CO.
Molded Plastics Division
OLIVE AND TAYLOR STREETS ELYRIA, OHIO

TELEVISION PRETTY SOON

(Continued from page 23)

O. B. Hanson, vice-president and chief engineer, NBC

Three or four days it took to get this effect together—plaster of Paris books stained to look ancient; steel wire covered with gilt and bent and twisted into spider webs. The leaves of the book are turned by an unseen hand which operates a row of knobs arranged just under the bench. The candle is channeled up the back. An air tube inserted in the opening leads to a bulb in the operator's hand. At the critical moment he squeezes the bulb, and pouf! Out goes the candle.

All this planning and conniving is for a one-time showing. For naturally, no visual effect can be used twice. Unless, of course, it is of a general character and can be saved until its first appearance is forgotten. The effects must be historically correct, too, because there's always somebody to pick flaws and criticize if they're not according to Hoyle.

Demonstration

A demonstration of television in actual operation is all that is needed to round out our trip and sure enough that comes next. In a partially darkened room, one of the newer receiving sets stands near the side wall. Good-looking piece of furniture it is, too, about the size of a console radio. Three knobs on each side of the front and one in the middle of the set control tuning, sight and sound.

A scenic diorama picked up by a television camera in an adjoining room flashes onto the screen. A toy train (electric model of Broadway Limited) comes around one corner, travels across the base of the picture to disappear at the far end. Our first glimpse of a television picture and are we impressed! At the guide's invitation half the group follows him into the next room, while the others watch the screen. The painting and toy train vanish. Then, almost at once, the guide appears on the screen, as natural as he had been a moment before in person. His voice comes clearly through the loud speaker as he asks each one with him to step up and be telecast. It takes no urging. One by one they come, say a few words and pass along. It seems little short of miraculous to watch their nervous, self-conscious movements and listen to their impromptu remarks. Strangers until a few moments ago they come back talking and laughing together like old friends, to watch the second half of the group go through its paces.

The lights under which the spur-of-the-moment actors stand are very hot, 1500 candle power; stronger than Kleig lights according to the guide, but not injurious to eyes because of the absence of ultra violet rays.

Somebody asks about static. It seems that static does not affect transmission over ultra high frequencies even during a severe electrical storm. A leaking neon sign, though, or a defective spark plug in an automobile will interfere, giving an effect of snow on the television picture. However, there are ways of overcoming these difficulties and they are being worked out.

Plastics are important

So our tour ends. But let's see what can be dug up in the way of supplementary information.

Modern materials have played no small part in making possible this modern miracle of transmitting sight and sound from a distance. According to O. B. Hanson, vice-president and chief engineer of NBC, plastics play an important part in television, even as they do in present day radio broadcasting. *(Please turn to the next page)*

Television trucks will roam the streets, go to ball games, prize fights, fires, police raids, to bring the news to you just as it happens

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TRI-PUMP INJECTION SYSTEM

(Ram travel speed in terms of cubic displacement)

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890 cubic inches displacement per minute at 14,400 pounds pressure per square inch

MOLD LONG DRAW or THIN SECTIONS — Heretofore impossible
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REDUCE FINISHING COSTS — Rapid injection requires smaller gates

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The Iconoscope camera "shoots" close-up of Laura Suarez (top), beautiful singing star of the Brazilian stage. Center: Monitoring Kinescope shows image and electrical equivalent on an oscilloscope at the right. Below: "Miss Patience," famous NBC manikin, stands immobile for hours while engineers observe camera and lighting experiments

"Wherever a light, easily worked and strong material with high insulation properties is required," said Mr. Hanson, "plastics are the answer to an engineer's prayer. In one form or another—control knobs, supports, mounting strips, sockets, condensers and other devices—from camera to control room to transmitter and antenna and finally in the home receiver, plastics are found.

"Molded phenolic is the principal plastic used. It has the required mechanical properties and meets the demand for low-loss insulation at most radio frequencies. Television, however, has brought extremely high frequencies into use, and it is here that polystyrene fills an urgent need. The fact that polystyrene's insulation property is heightened in proportion to the increase of frequency, has made it valuable at certain points in the television system. Also, since the material is practically impervious to moisture, it is used to coat many electrical devices."

Up to now, television has been confined more or less to experimental laboratories and field tests, but it has finally grown up to the point where it is ready to be introduced formally to society. Its debut is scheduled to take place at the time of the New York World's Fair opening and it has been announced that receiving sets are to be offered for sale in the spring. "High time, too!" do we hear someone say? Well, of course, there has been plenty of talk, and reams have been written on the subject ever since it first became a possibility considerably more than ten years ago. And with television in actual operation in England for a year or more, it did look as if this country were a bit slow on the uptake. But there has been a reason for the delay. Several reasons to be more exact.

Standardization necessary

During all these years, research chemists and engineers have been grooming this pet of science to take its place in the world. Building one month, tearing down the next, each discovery for the improvement of transmission facilities calling for corresponding changes in receiving apparatus. Which meant that receiving sets, had they been produced commercially, would become obsolete so fast, there wouldn't be any point in buying one. The establishment of standards was imperative.

"Television differs from sound broadcasting very markedly in the importance of standards," says I. J. Kaar, design engineer of the General Electric Company's Radio Division. "In the latter, the technical quality of transmitted programs can be improved year by year, and while this happens, a receiver once purchased is always usable, even though it may become outmoded. The situation in television is quite different. Because of the use of scanning and the necessity of synchronization between receiver and transmitter, if transmission standards are changed, receivers designed for the old standards become useless. Because of this fact, no responsible manufacturer would sell receivers to the public until standards were fixed by the industry and sponsored by the Federal Communications Commission."

As mentioned before, in television the picture is scanned at both camera tube and picture tube by an electronic beam in a series of horizontal lines. The number of lines into which the picture is divided in the scanning process determines the fineness of vertical detail which is reproducible. After scanning the whole picture, the electronic spot repeats the process at a sufficiently rapid rate so that no apparent flicker exists. The frequency of repetition of scanning the whole picture is known as frame frequency. In order to conserve ether space, it is desirable to keep the frame frequency as low as possible, and an artifice, "interlacing," is employed

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WHAT'S THE DIFFERENCE BETWEEN ONE MOLDER AND ANOTHER?

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P.M.C. can refer you to half a gross of clients—in almost every line of industry—who have found its prices right, its molding perfect, its inspections rigorous and its promises performed or exceeded.

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to increase the apparent frequency of repetition. It consists of scanning every other line, then scanning those in between which were missed the first time. This gives the physiological effect of scanning the picture twice, as far as flicker is concerned, even though all details of the picture have been scanned only once. The apparent flicker frequency under these conditions, which is twice the frame frequency, is known as field frequency. In America the number of lines per frame has been standardized at 441, the number of frames per second at 30 and the number of fields per second, interlaced, at 60.

Among other matters requiring standardization are the synchronizing operations at both transmitter and receiver. To keep the error small, synchronizing signals are always transmitted with the picture signals. The purpose of these synchronizing signals is to start the scanning of both lines and frames at exactly the right time. That is obviously important.

"It required considerable technical perfection to justify the high standards," says Mr. Kaar, "but this has now been attained and essential standards agreed upon. It may be said with some assurance that the last technical obstacle in the path of commercial television, at least so far as the excellence of the picture under proper conditions is concerned, has been removed."

For a long time, proper make-up for television artists bothered technicians. Famous make-up artists were pictured employing monstrous shades of greens, blues and browns on the face so that it would "reproduce naturally." Other make-up experts devised special creams and pencils for treating a face to be telecast. Many of the methods were so far from being natural as to be grotesque.

"Years ago when the 60-line screen was the best television could offer," says Albert F. Murray, engineer in charge of Philco's Television Research, "there was a great deal of difficulty in bringing out detail and facial features. Red lipstick showed almost white, and such things as eyebrows were hardly apparent. Artificial make-up employing heavy brown colors was resorted to in order to obtain a picture which would be distinguishable. At present, with the use of the 441-line screen, there is no difficulty in obtaining clear and detailed reproduction without make-up. Tests have proved that proper make-up has been more of an engineering feat than one of cosmetics."

These factors satisfactorily taken care of, there still remain other questions that will take a lot of answering:

How can television programs be relayed economically?

The ultra short wave used in television resembles the light wave in that it travels in nearly straight lines and refuses to follow the curvature of the earth. It has also been found that the ionosphere, or "radio ceiling," which reflects longer radio waves back to the earth and thus widens the service area of the ordinary broadcasting station, permits these high frequencies to pass through. At the present time, therefore, pictures can be broadcast only about as far as you can see on a clear day; then, apparently, they jump off into space.

Much remains to be learned about ultra short waves and their behavior, but science has provided at least two possibilities of linking television stations into a network. One, the coaxial cable, is a high grade metallic conductor capable of passing the great number of frequencies used in television. Installed, however, it costs something like $5,000 a mile and at present there is but one such line in use, connecting New York and Philadelphia. The second method of networking is to provide relays by automatic radio "booster" stations, but these are expensive, too.

Dr. W. R. G. Baker, chairman of the Management Committee of General Electric Company's Radio and Television Division feels this way about it. "Two major technical limitations," he declares, "still act as a deterrent to the rapid establishment of television on a national basis. First, we do not as yet know how economically to 'pipe' programs from city to city. Hence television networks are not yet practicable. While it is true that television transmissions can be piped by special wire circuits and by relays of special radio transmitters, neither of these methods appear to be economically possible in the near future.

"The second technical problem is the limitation of range or distance. A fairly high power television transmitter is now limited to a radius of not more than 40 or 50 miles. This immediately indicates that a great many transmitters will be required to provide a national service. It also means that, considering the probable cost of television transmitters, the economics of the situation will at first tend to limit transmitters to urban areas where the population is dense. Extension of service to remote suburban rural areas necessarily will be slow."

Who will pay for programs?

The present radio broadcasting system, with its commercial sponsors who pay the bill, requires the existence of tens of millions of receivers, with listeners who may be induced to buy the advertised products.

"Such an audience does not exist in television," says Mr. Kaar, "and cannot be expected for several years. Of course, no such audience existed in the early days of sound broadcasting, either, and the receiver manufacturers, along with a few others, operated the stations. In those days, however, the thought of something coming through the air, receivable at no cost, was an entirely new one. People were quite satisfied with the new toy as such and program excellence was a secondary consideration. This meant that the cost of broadcasting, as compared to the present, was low. Now the public has been educated to expect a high degree of excellence in program material. In other words, when television is born, it must be born full-fledged as far as program material is concerned. This means great expense, which undoubtedly will have to be borne by the pioneers."

Large sums of money have already been spent, with more to follow, in preparing for television service. A new RCA-NBC television antenna is being installed on

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top of the Empire State Building. The National Broadcasting Company is working on outdoor broadcasts with a mobile television station in two large motor vans. The Columbia Broadcasting Company is spending $500,000 to erect a transmitter atop the Chrysler Building. The General Electric Company is reported to have appropriated some three-quarters of a million dollars for television programs. The Philco Radio & Television Co. is ready with a transmitter in Philadelphia. And this is only the beginning!

Type of program

Television, it is believed, eventually will be able to offer a service that can be accomplished by no other medium. That is the transmitting of events while they are taking place. Fortunate owners of television receivers may, at some future time, sit back in their own comfortable chairs, in their own homes and watch a favorite football team win over its opponent. They may tune in at the inauguration of a President of the United States and hear his voice as he takes the oath of office. They may thrill at the spectacle of a famous flier taking off for a record flight. Sometimes, unexpected drama may be flashed on the screen in front of them. Like the time in England when, during an Armistice Day celebration, a fanatic broke through the outer edge of the crowd brandishing a gun as the King and Queen passed by. All this may some day be possible. In the meantime, what form will television entertainment take? Many things have been tried experimentally, plays, filmed programs, fashion shows. But before any definite decisions can be made, the public must be given a chance to get in its two cents' worth. This can be done only through the operation of television transmitters and the sale of television receivers.

"Only by public participation," states Dr. Baker, "can the art of television be advanced, and the system—technical and program—be brought nearer perfection. There can be no question of the ultimate service of television to mankind. It unquestionably will have a far greater influence than radio when it has been brought to an equal state of perfection, for in this new art we add sight to sound and thus appeal to the two most powerful senses."

PREVENT BREAKAGE—REDUCE NOISE

(*Continued from page 28*) is softer than the metal feed star such a nick or burr does not harm other bottles as they feed through the machine.

The handling of glass on semi-automatic or fully automatic machines is a noisy operation due to the very nature of glass. The machines in themselves are quiet in operation, in fact, noiseless, but glass gives off a metallic noise when in contact with other glass or metal. This noise is particularly noticeable as glassware being fed to automatic machines enters the feed guides and the feed star and the use of a plastic has eliminated much of this noise. This factor is of prime importance in those plants where more than one bottling line is used. Bottle din is kept to a minimum, nerves receive a welcome vacation from unnecessary noise, and such records as are available indicate that employee morale is definitely improved. And the beauty of this is that the purchaser of equipment does not pay one cent more for all the additional advantages.

The three advantages listed above are those that accrue to the purchaser of equipment using plastic in its construction. The fourth advantage is derived solely by the manufacturer. The U. S. Bottlers Machinery Company state that machining is easier with the plastic than with metals, and because it is easier, chances for mistakes are practically nil. There is less spoilage, and the difference in spoilage definitely compensates for the slightly higher price of the plastic material. The difference in weight is also a factor. Less weight on the feed and discharge stars means less load on the motors and driving mechanisms.

Summed up, then, the advantages of using a laminated plastic on the feed and discharge stars and the feed and discharge guides on machines of U. S. manufacture are as follows: anti-corrosive properties, able to stand greater punishment from incorrectly fed bottles; elimination or reduction of noise; and greater ease in machining and shop work.

WHEREFORE INJECTION MOLDING

(*Continued from page 27*) these were operable, after a fashion, they were a constant source of trouble caused by material lodging in the crevices (which inevitably developed between the lugs and the cylinder wall). This not only caused discoloration and dirt contamination but practically destroyed the heat transfer from the externally heated cylinder wall to the internal heating body ("spreader"), thereby defeating its entire purpose.

By a devious path of investigation over the last two years involving the establishment of the importance of these several factors, largely by the method of trial and error, the developments led to the so called "integrally mounted" spider whereby the internal heating body was a unit part of the cylinder itself leaving no joints to come and go with temperature changes and to be filled with stagnant plastic material. This construction has been proven out within our own plant on both experimental and production bases and has the further merit of, by proper design of the heat conductivity paths, maintaining the spider at essentially the same temperature as the cylinder wall itself. This allows for uniform heat input to the resin mass from two or more sides and thereby lessens the tendency for surface superheat in the resin adjacent to the heating surface. The feature of operating cylinders at a low surface temperature differential may involve increased length of the effective heating zone to accomplish the desired results but if reduced heat punishment to the material and enhanced temperature uniformity are accomplished it is still desirable. It must be borne in mind that the ultimate length of the heating

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As you can see, we started to highlight this ad for plastic-plus-metal with the standard symbol of beauty. But we decided the illustration was no go. It doesn't put across the classic elegance that is characteristic of *Plastic-plus-Metal* . . . it doesn't suggest the rich variety of attractive effects that can be achieved.

Grammes-made decorated metal fittings are being used in many ways by manufacturers of molded plastics: Colored or embossed metal medallions or shields for added smartness . . . Metal name plates to give sharp definition and distinctiveness to product-name or trademark . . . Metal fittings to improve the looks and durability of beer knobs, toys, giftware.

If you mold plastics, you will find it profitable to investigate the possibilities for improving attractiveness and usefulness (and *sales!*) through plastic-plus-metal.

Consult Grammes. Our designers and technicians are thoroughly equipped to work with you. Write for further information—*today*!

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But at American Insulator, we've both ingenious engineers who will help you earn those dollars and new high speed equipment to save nickels and dimes by doing better work.

AMERICAN INSULATOR CORP.
NEW FREEDOM, PENN.

zone should be kept within the limits of the allowable pressure drop consumed in forcing the charge through the heating area. It is obvious that these factors of internal heat transfer are common to all cylinder heating methods whether they involve steam, hot oil, conductivity from external electrical resistance elements or the more recent electrical induction heating type.

As a corollary to the general feature of uniform heating cylinder temperatures, the means of accurately measuring and controlling those temperatures becomes a feature of considerable importance. In the earlier machines temperature control was largely manual and measured by glass thermometers inserted in wells in the cylinder proper. This procedure, while positive, was beset with high thermometer breakage and left all temperature adjustments up to the opinion and vagaries of the machine operator. Later improvements have come along in the way of thermocouple and gas bulb thermometer temperature indicating instruments, and the whole situation is improving through the use of automatic cylinder temperature control devices. It is of particular importance, however, that detailed attention be given to both the accuracy and location of the thermometer or thermocouple being used so that one can be assured of measuring true temperature conditions at a point where those readings are most indicative of the thermal facts within the cylinder proper. It is the opinion of the authors—based on past experience—that thermocouples, properly located, are preferable to gas bulb type temperature measuring devices in their enhanced accuracy and freedom from maintenance, and that where automatic temperature regulation is included, it is best accomplished through balanced potentiometer type control devices rather than the cheaper millivolt meter construction. This statement applies for both the temperature indication and automatic control devices.

Where the heat input to the cylinder is by electrical means, whether resistance—conduction or induction, it appears that considerable advantage can be gained by splitting up the actual heat generating elements into a plurality of two or more units, with separate controls on each, so that a proper temperature gradient can be maintained throughout the cylinder in the direction in which the plastic charge is moving. This has advantages in respect to both the perfection of the plastifying job being done and economy of the energy consumed in doing it. It is quite definitely indicated that this feature of heating energy consumption will become one of increasing importance and that it will be of a noticeably different order of magnitude for the different materials used.

When it is considered that any heating cylinder must function under conditions of alternately high and low internal pressure and with prolonged exposure to relatively high temperatures, it is natural that distortional forces come into play which render the preservation of tight joints between demountable members a definite problem. For the reasons previously mentioned, all internal joints must be perfect fits and continuously maintained so. It is furthermore desirable, if possible, to keep joints subject to serious distortion at the cooler end of the cylinder, because infiltration will be minimized at positions where the temperature of the resin mass is lowest. Restraining pressures on heating cylinder joints seem to be more practically maintained by compression through bolts or Allen set screws than by large nuts or circumferentially threaded members (as was the original practice), and increase of the unit bearing pressures by decrease in the bearing area on joints has proven desirable.

The matter of internal stream lining of heating cylinders is becoming of increasing importance as larger capacity cylinders are required. Any construction which permits of unbalanced internal flow of the plasticized resin stream is bad on several counts, where the prerequisite of temperature uniformity becomes increasingly important. There is, undoubtedly, a definite heating effect arising from the frictional forces in the movement of the resin stream at these high velocities. Furthermore, constantly increasing velocity (obtained by regularly diminishing cross-sectional dimensions) of the resin stream once it has been properly plasticized and leaves the effective heating zone seems to be a most important feature. Increased velocity minimizes the tendency for resin to adhere to the hot cylinder walls.

Considering good heating cylinder design and enhanced quality of the resultant casting, it is believed that the present practice—of expecting the same heating cylinder to function equally well on castings consuming a 2 oz. material charge and those consuming 8–9 oz.—will ultimately be revised. The capacity and rating of the heating cylinder should, within certain commercial limits, be balanced with the job being performed and a range of cylinders of different capacities should be available to essentially match the weight of the product required. This is true because, fundamentally, optimum heat transfer and plasticizing characteristics cannot be built into a cylinder handling widely varying outputs of plastified material.

It appears that further advantage could be gained by a more general practice of chromium plating the internal parts of heating cylinders. This feature has merit on several counts. It is not a particularly expensive operation to apply about .002 in. hard chromium plate to a suitably polished heating cylinder. Cylinders so treated have a distinct advantage from the standpoint of cleanliness and ease of color preservation where light pastel shades are involved and, what is really more important, the frictional effects of hot resin on the metal are markedly reduced—in some cases with chromium as much as 30 percent of that factor with hot resin in contact with steel. Anything which reduces friction and natural sticking inside the heating cylinder is advantageous.

It is indicated that with control and perfection of heat transfer proven to be such important factors, the use of some of the more highly thermally conductive alloys, such as those of the copper-beryllium group, may be desirable as materials for construction in these parts. This may be particularly true with heating cylinders of the "integral type" where machining problems arise which may be simplified by the use of castings or forgings to simplify the machining. (*Please turn to next page*)

BECAUSE SHE WON'T BUY OFF-SHADE

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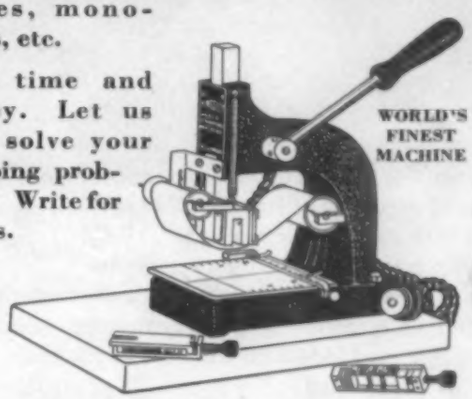

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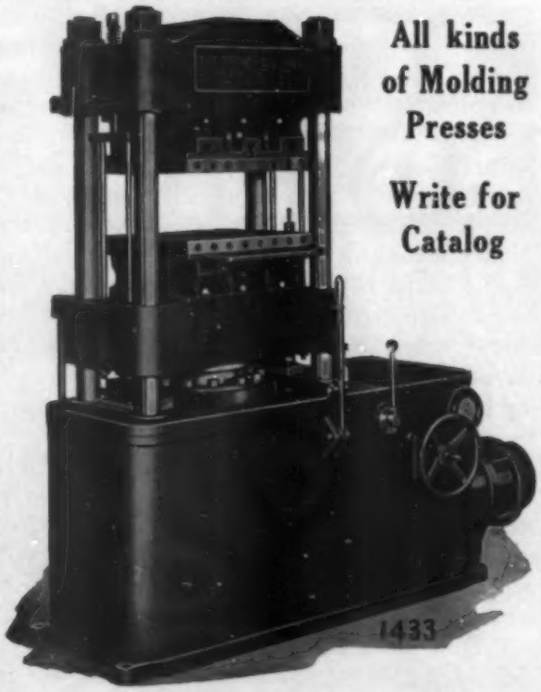

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Two diagrammatic sketches of heating cylinders embodying some of the points herein set forth appear at the beginning of this article. Both of these sketches include the "integral" type of cylinder construction but with modifications involving the (1) parallel path (Fig. 1) and (2) converging path (Fig. 2) type of heating zone. Both have been used in experimental as well as production molding for some period of time and their respective merits pretty well established. It is confidently believed that no matter what material is involved in the injection molded part, its utilization will be facilitated by consideration of many of these factors. Furthermore, and what is more important, the advent of larger and larger castings with the necessity for higher quality standards in the way of appearance, strength, elimination of "skin" effects and flow lines, reduction of weaknesses opposite the gate or sprue, and enhanced knitting strength at the junction of two resin streams, will combine to necessitate more attention to many of these factors than has been the case so far. Crudely speaking, we in the injection molding business have "gotten by," but further progress may be somewhat contingent on continued attention to the engineering aspects of the available machines in relation to the materials used and the parts produced.

BREAKING RECORDS TO KEEP RECORDS

(*Continued from page 31*) few weeks ago, the manufacturer announced that, working with the Cardineer Corporation, it had at last perfected its record-keeping machine and was placing it on the market.

The Cardineer still consists of a large wheel suspended in a rolled-steel cabinet. This time the wheel is molded of a special phenolic material, is almost two feet in diameter, and weighs fifteen pounds. The crowned top of the cabinet slides back to reveal the cards—6500 of them—attached to the wheel by means of the metal segments, which are secured by a patented locking device. The Cardineer opened, the operator grasps a chrome-tube wheel concentric to the plastic wheel and turns the cards to the desired position. If she is posting or stamping cards she leaves them on the wheel; if the checking requires writing she removes the cards, still on their metal arc, to a posting table built especially for use with the Cardineer.

Safe in practice as well as in name, Diebold gave the idea a thorough testing out before placing the machine on the market—found that eight of them, desk-installed (wheels without cabinets) in a New York mail-order house, increased average production up to 75 percent, and at the same time eliminated absences due to fatigue and eye-strain. Three Cardineer cabinets in a New York retailer's refrigeration service department put 21,000 cards at fingers' tips for a single operator . . . ten supervisors in a Chicago bank's bookkeeping department use Cardineers to check signatures accurately and rapidly. In the same bank all commercial tellers use desk installed Cardineers to check signatures without delaying or offending depositors, from whom the cards are concealed. The cards formerly used were not discarded; punched and threaded, they were installed on the new device, are still being used.

Which pretty well outlines the story of how a production problem was worked out. . . . What's that? the molding problem? Well, there isn't much of a story there; the wheel is molded in two half sections, each with one large steel tube insert and seven smaller brass inserts. Each half-wheel weighs almost seven and a half pounds. But the job was really all in a day's work to the molder. No new equipment was necessary; a regular 500-ton press and the molder's own mold-making facilities were used. General-purpose phenolic was used on the wheel, except around the axle, where the special strength compound is used. Here, a material formulated to have low shrinkage and greater resistance to strains set up around large inserts became necessary. The wheels are made with three peripheral face widths, $2\frac{1}{2}$ in., 3 in. and 4 in., giving the outer rim of the assembled wheel widths of approximately $6\frac{3}{16}$ in., $7\frac{1}{4}$ in. and $8\frac{3}{4}$ in. The $9\frac{5}{8}$ in. long steel-tube axle is inserted in the yoke. In molding the wheel, a guide pin in the plunger telescopes through the axle. When the material is cured the wheel, lying face down in the mold, adheres to the plunger and is removed therefrom. The seven brass inserts are staggered in each half-wheel so that when the two halves are assembled the inserts act as fourteen bosses, alternately male and female, which further secure the halves after they are bolted together. The same general procedure is followed in molding the small wheel ($6\frac{1}{2}$ in. diameter) which is used on a desk-top model Cardineer holding 1500 cards.

On the use of plastics for the wheel, Earl Boughton, Diebold production engineer, has some pertinent remarks: "As we progressed with designs based on the use of plastics," he says, "we were more than ever convinced of their advantages. Provisions for the small integral parts were made without difficulty, and in comparing the cost of tools for metal stamping, die casting and plastic molding we found very little difference.

"In summing up these facts we found plastics to be the most economical from the standpoint of both tool and manufacturing costs. Plastics eliminated difficult machining operations that would have been required with the use of sheet steel—eliminated the necessity of welding several pieces to form a half section—eliminated the preparation of surfaces for plating.

"The whole half section, axle, bearing pins and bolt-holes, are molded in plastic of one piece, light in weight, requiring no welding, painting or finishing whatsoever to produce a finished unit that incorporates the eye appeal so necessary for blending Cardineer filing systems into modern office surroundings."

The moral—if there is one—is that molded plastics, through the advances constantly being made in materials, design and mold engineering, are more and more suitable for use as larger parts. Plastics, in other words, as custom built materials, can be hand tailored to meet successfully almost any given set of conditions.

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BARCO MANUFACTURING COMPANY
1813 Winnemac Avenue
Chicago, Illinois

ETHYL CELLULOSE FILMS AND PLASTICS

(*Continued from page 46*) in an oven up to 90° C. during about thirty minutes, inserted in the instrument and the electrical and temperature readings taken simultaneously as the plastic cooled.

TABLE IV.—EFFECT OF HEATING ON DIELECTRIC PROPERTIES OF ETHYL CELLULOSE PLASTICS

Pieces heated 24 hr. at temperature, cooled to 20° C. and tested at 1000 cycles

	Plastic	25° C.	40° C.	60° C.	80° C.
Weight loss, percent	A	0.0	0.37	0.60	0.55
	B	0.0	0.42	0.65	0.59
Thickness change, percent	A	0.0	−2.1	+1.53	+0.8
	B	0.0	−1.6	+1.09	−0.4
Dielectric constant	A	3.23	3.03	2.98	2.88
	B	3.19	3.00	2.88	2.84
Power factor (tangent of the loss angle)	A	0.0178	0.0162	0.0160	0.0158
	B	0.0192	0.0168	0.0159	0.0167
Loss factor*	A	0.058	0.049	0.047	0.045
	B	0.061	0.050	0.046	0.047

* Product of the dielectric constant and the tangent loss angle.

Effect of thermal exposure

Duplicate test pieces of plastics A and B were heated for 24 hours at 40° C., 60° C. and 80° C., respectively. The pieces were allowed to cool to 24° C. at 50 per cent relative humidity for one hour and again tested for power factor and dielectric constant. The molded slabs retained their original appearance after being heated and did not check, crack or become brittle. The percentage change in weight, thickness, dielectric constant and power factor are shown in Table IV, and the average values from the actual tests are plotted in Fig. 6. It is seen that heating the plastics improved their value as dielectrics at room temperature. This result is due to baking out traces of moisture amounting to 0.5 to 0.6 percent since the heated samples regained their original weight after 4 days at 50 percent relative humidity and 24° C. temperature.

The fact that the percentage change in thickness is small and within the limits of error in measurement indicates the dimensional stability of ethyl cellulose plastics with variation in temperature. Taken with the evidence that the weight loss is entirely due to moisture, it also shows that the plasticizers in the plastic are nonvolatile and that the plastics contain no appreciable amount of volatile solvents.

TABLE V.—EFFECT OF WATER ON AN ETHYL CELLULOSE PLASTIC

On Ethyl Cellulose Plastic A	As Molded	Immersion in Water 48 hours at 25° C.	Immersion in Water 48 hours at 70° C.
Weight increase	....	2.2%	7.3%
Thickness increase	....	1.3%	9.6%
Dielectric constant, 1000 cycle	3.30	3.84	4.06
Dielectric constant, per cent increase	....	16.4%	23.0%
Power factor, 1000 cycle	0.0197	0.0240	0.0250
Power factor, per cent increase	....	22.0%	27.0%

Effect of immersion in water

Test pieces of ethyl cellulose plastic A were injection-molded and immersed in water for 48 hours at 25° C. and at 70° C. The samples were run in triplicate, and the average effect of water on their weight, thickness and dielectric properties is shown in Table V.

The effect of water immersion on the dimensions and electrical properties of the plastic at 25° C. is comparatively slight, as the data of the table show. At higher temperatures, more water is absorbed, resulting in increased thickness and decreased insulating properties. When dielectric constant and power factor of the plastics are plotted against moisture content, curves tend to approach zero moisture content line asymptotically.

Extruded plastics

Extruded wire coatings and small bore insulating tubing are natural applications for ethyl cellulose plastics. In coating wire, the plastic is heat-softened and extruded through an orifice through which a wire is drawn, covering the wire evenly with plastic. The coating hardens immediately upon cooling and is tough and flexible. This use requires a larger proportion of plasticizer and that the plasticizer be selected for its electrical properties and lack of toxicity as well as its effect upon the toughness, flexibility and hardness of the plastic. The effect of exposure to heat and water upon the electrical properties of wire coatings made with ethyl cellulose plastics follows the same general trend as shown for the injection molding plastics, except that the flow requirements of the extrusion plastic permit the incorporation of larger amounts of materials with moisture-retarding properties.

LIGHT WITHOUT GLARE

(*Continued from page 39*) may be changed to produce, in effect, an entirely new lamp without altering the main body of the mold in any way. So carefully were the molds planned, so ingeniously were the shapes designed to accommodate the flow and curing of the phenolic material that the molder reports that no final changes were necessary and that he had the minimum of difficulty in getting this complicated piece into efficient production.

In use the virtue of the lamp is easily demonstrated. With all parts of the working surface glarelessly illuminated it is not necessary for the eyes to struggle to adjust themselves to spots of glittering light. Eye strain, with its accompanying dangers, is eliminated. The lamp is highly efficient and delivers a generous flood of light to the working surface although this is hard for the user to believe, accustomed as he is to using glare as an index of the amount of light. The light-meter shows a much higher illumination than with ordinary, glaring lamplight.

The lamp would hardly be possible without plastics. Polaroid itself, whether alone as a film or in a glass sandwich, is a plastic material. In making experimental cases other materials and techniques were considered and even tried but the cost of assembly and finishing resulted in a prohibitive price. This lamp is low enough in manufacturing cost to bring the virtues of polaroid to anyone able to buy a desk lamp without sacrificing a satisfactory profit for those who make and sell it.